O

JURONGVILLE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2022
Secondary 4 Express

STUDENT NAME

CLASS

INDEX NUMBER

BIOLOGY

6093/01

Paper 1

31 August 2022

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

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

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 separate Answer Sheet.

Read the instructions on the 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.
The use of an approved scientific calculator is expected, where appropriate.

DO NOT OPEN THE BOOKLET UNTIL YOU ARE TOLD TO DO SO

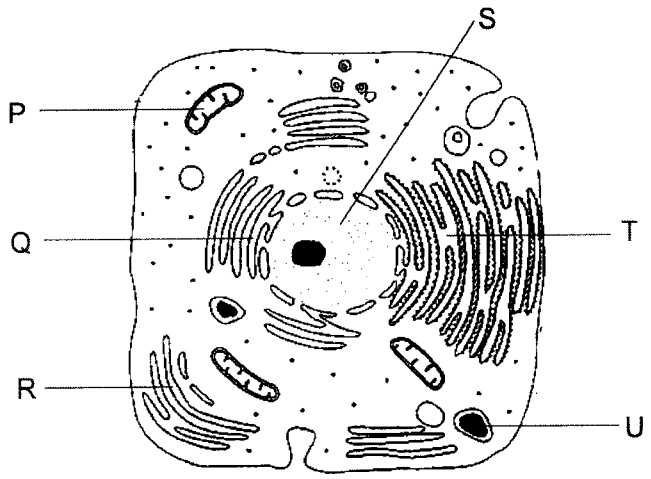
For Examiner's Use
40

Setter: Ms Kay KW

This document consists of **21** printed pages.

[Turn over

Refer to the diagram of a typical animal cell to answer questions **1** and **2**.



1 Which of the following correctly matches the organelles where the molecules are formed?

	fats	mRNA	polypeptide	carbon dioxide
A	P	Q	U	R
B	Q	S	T	P
C	Q	T	R	P
D	T	S	Q	R

2 Which of the following correctly states the processes occurring in the organelles?

	Q	S	T
A	detoxification	translation	transcription
B	translation	replication	transcription
C	detoxification	transcription	translation
D	replication	transcription	translation

[Turn over

3 The diameters of three onion rings were measured before and after they were immersed in 50 cm^3 of sucrose solutions at different concentrations for 20 minutes. The results were recorded in the following table.

onion ring	initial diameter / cm	final diameter / cm
1	5.5	4.2
2	5.8	6.2
3	6.6	5.9
4	7.1	6.3

Which of the following correctly arranges the solutions that the onion rings were immersed in from the highest to the lowest water potential?

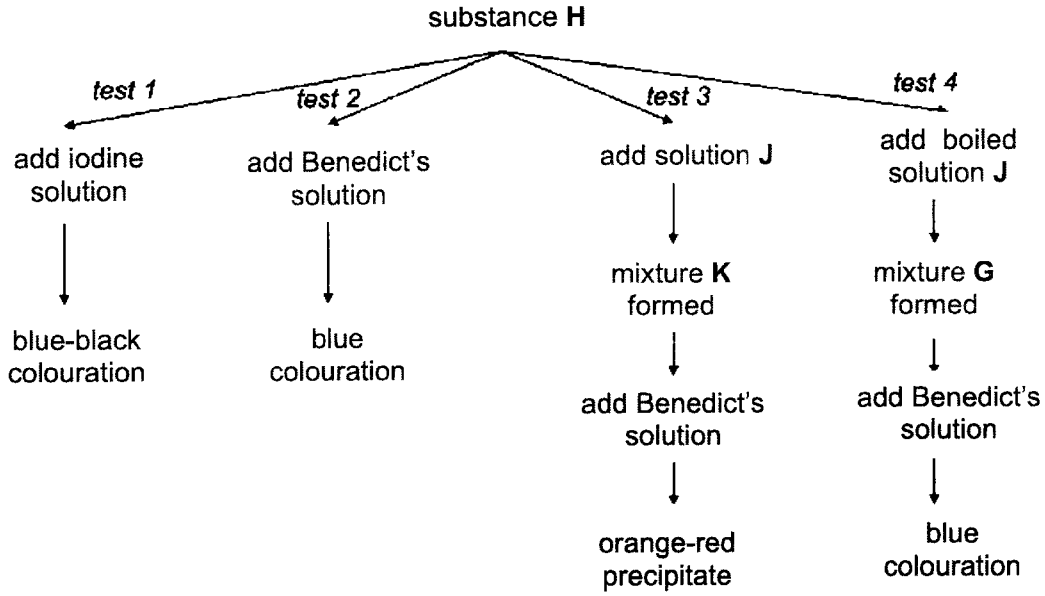
	highest	⟶		lowest
A	1	3	4	2
B	1	4	3	2
C	2	3	4	1
D	2	1	4	3

4 Influenza virus has an enzyme called neuraminidase which breaks down glycoproteins in the membrane of the cell that the virus infects.

According to the lock and key model of enzyme action, which is the lock and which is the key?

	lock	key
A	cell membrane	virus
B	glycoproteins	neuraminidase
C	neuraminidase	glycoproteins
D	virus	cell membrane

5 The diagram shows a series of experiments carried out by a student on unknown food substance **H**.

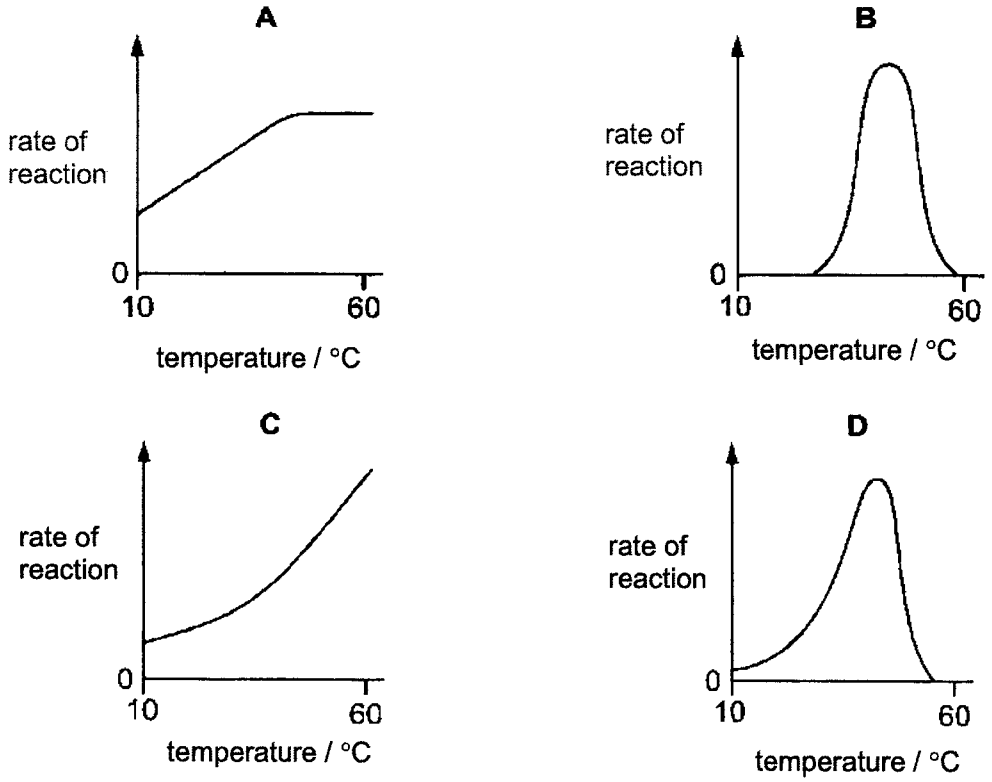


Which row correctly identifies substances **G**, **H**, **J** and **K**?

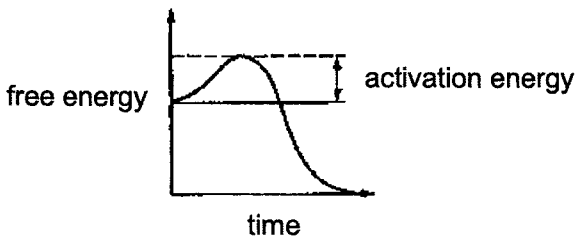
	G	H	J	K
A	reducing sugar	starch	saliva	starch
B	reducing sugar	reducing sugar	saliva	starch
C	starch	saliva	reducing sugar	reducing sugar
D	starch	starch	saliva	reducing sugar

6 An enzyme needed for respiration was extracted from bacteria living in natural hot water springs where the water temperature is between 85 °C and 95 °C.

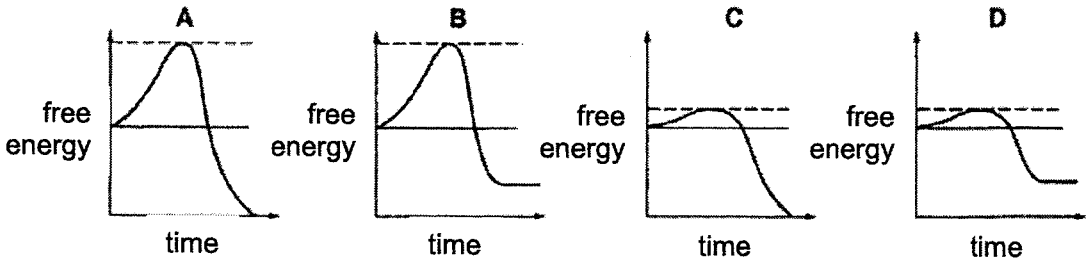
Which graph would represent the relationship between temperature and the rate of bacterial respiration?



7 The graph shows energy changes during an enzyme-catalysed chemical reaction.



Which graph shows the energy changes for the same reaction when the enzyme is absent?



[Turn over

8 Cystic fibrosis affects the cells that produce mucus, sweat and digestive juices. In patients with cystic fibrosis, thick mucus blocks the pancreatic duct.

Which are the possible effects of this blockage?

I. egestion of oily stools
II. high blood pressure
III. malnourishment
IV. weight loss

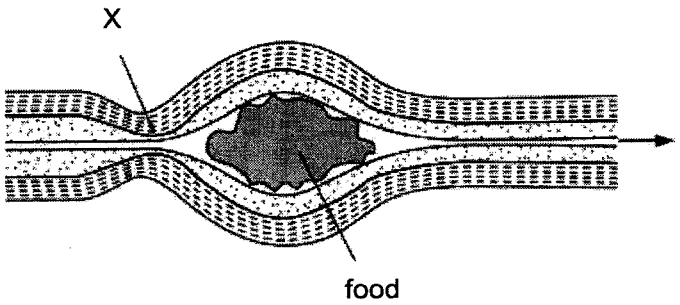
A I and III

B I, II and III

C I, III and IV

D II, III and IV

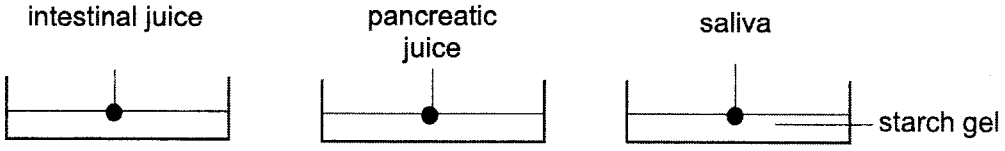
9 The diagram below shows a bolus of food moving along the alimentary canal.



Which of the following options best describes the action of the two sets of muscles at point X?

	circular muscles	longitudinal muscles
A	contract	contract
B	contract	relax
C	relax	contract
D	relax	relax

10 Drops of digestive juices from different regions of the alimentary canal were added to petri dishes coated with starch gel as shown below. After 1 hour, the starch gel was rinsed with distilled water and iodine solution was added to each spot.

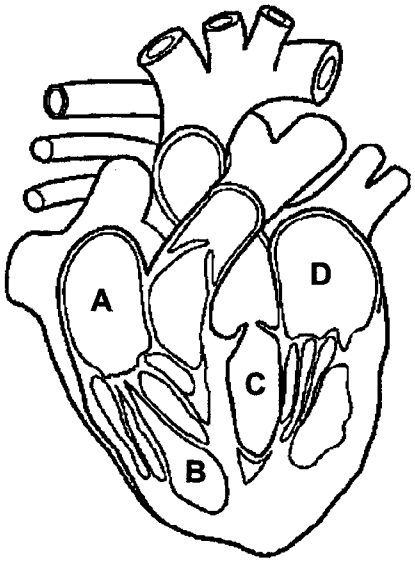


Which of the following would show the colour of the iodine solution at the spot?

	intestinal juice	pancreatic juice	saliva
A	blue-black	blue-black	brown
B	blue-black	brown	brown
C	brown	blue-black	blue-black
D	brown	brown	blue-black

11 The diagram shows the chambers of a human heart.

Which chamber will exert the highest pressure during contraction?



12 The table below shows the blood groups of four people and the type of blood they received in a transfusion.

person	recipient's blood group	donor's blood group
1	O	A
2	A	AB
3	B	O
4	AB	B

Which two people are at risk of agglutination?

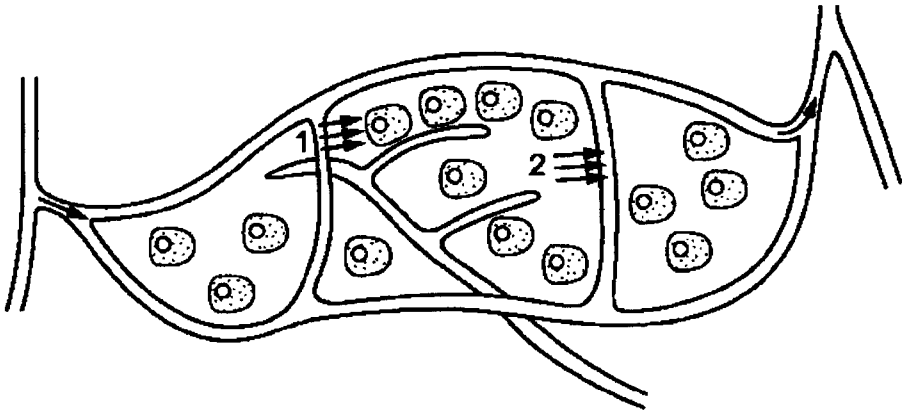
A 1 and 2

B 1 and 3

C 2 and 3

D 2 and 4

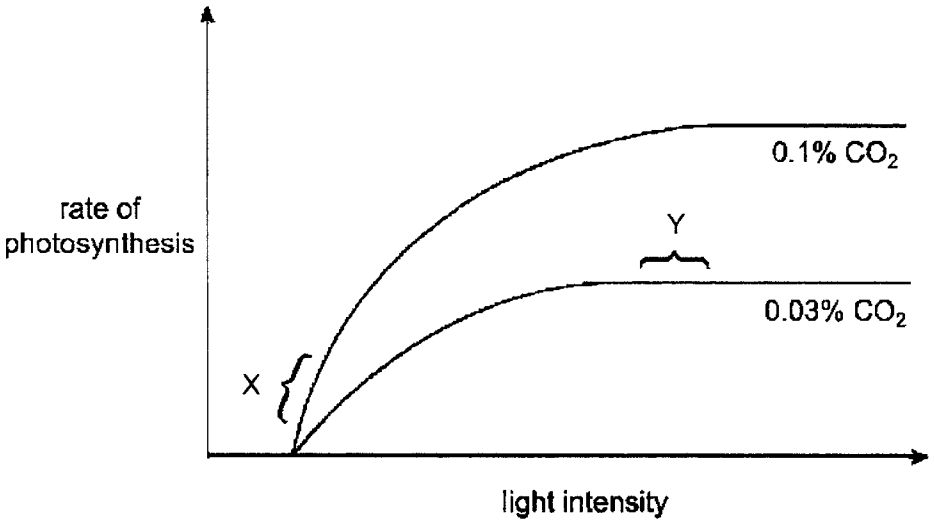
13 The diagram shows capillaries with the direction of movement of materials.



What is happening at position 1 and 2?

	1	2
A	carbon dioxide leaves the blood	urea enters the blood
B	oxygen diffuses	red blood cells return to the blood
C	red blood cells move out of the capillary	carbon dioxide diffuses
D	white blood cells enters the tissue fluid	waste products enter the capillary

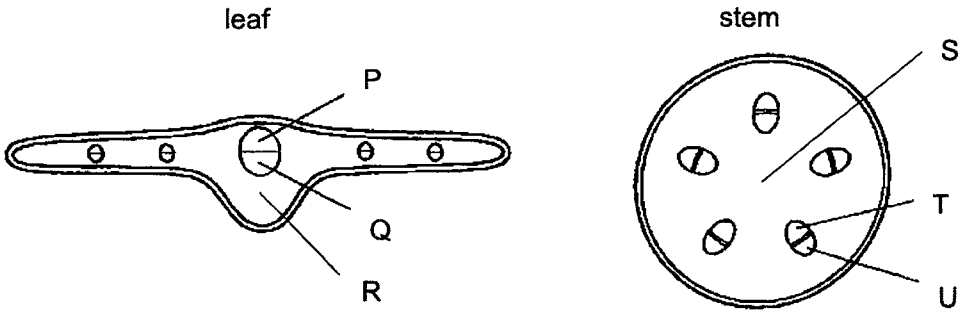
14 The diagram shows the graph of the rate of photosynthesis against light intensity.



What are the limiting factors of photosynthesis at regions X and Y?

	region X	region Y
A	CO_2 concentration	light intensity
B	CO_2 concentration	temperature
C	light intensity	CO_2 concentration
D	light intensity	temperature

15 The diagrams show the sections through a leaf and a stem.

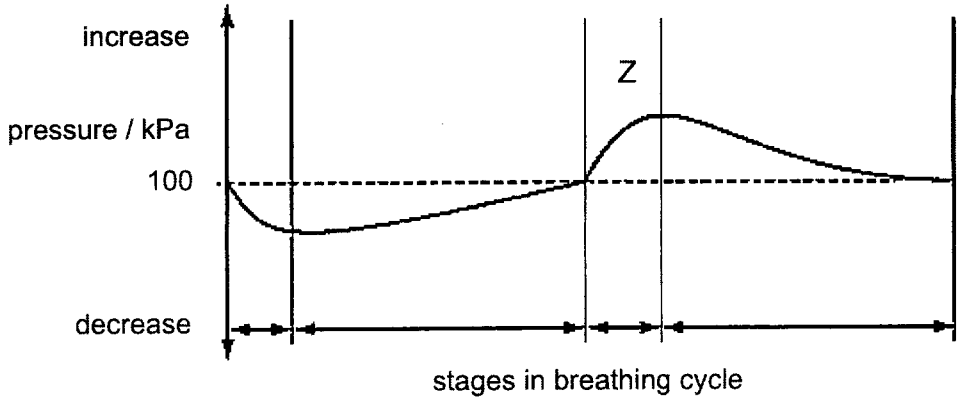


Where can amino acids be found?

	leaf	stem
A	P	U
B	Q	T
C	Q	U
D	R	S

[Turn over

16 The graph shows changes in the air pressure within the lungs during a breathing cycle.



What happens to the diaphragm and internal intercostal muscles at stage Z?

	diaphragm	external intercostal muscle	internal intercostal muscle
A	contract	contract	relax
B	contract	relax	contract
C	relax	contract	contract
D	relax	relax	contract

17 Which of the following states the correct end products of anaerobic respiration?

A lactic acid

B lactic acid + carbon dioxide + energy

C lactic acid + ethanol + energy

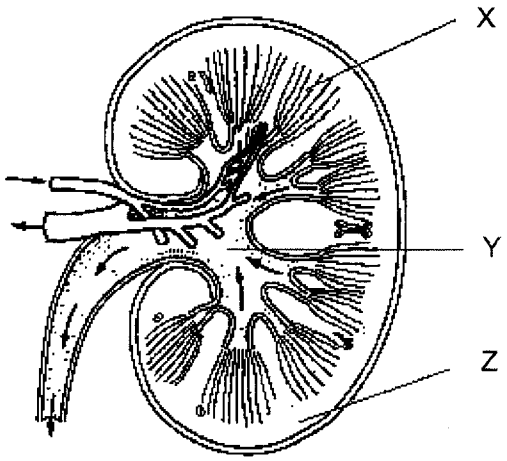
D lactic acid + energy

18 Which row shows the effect of chemicals in tobacco smoke on human health?

	chemical	causes	increased risk of
A	nicotine	makes blood clot easily	emphysema
B	nicotine	paralyses cilia lining	chronic bronchitis
C	tar	makes blood clot easily	chronic bronchitis
D	tar	paralyses cilia lining	emphysema

;'

19 The diagram shows a cross-section of a human kidney.



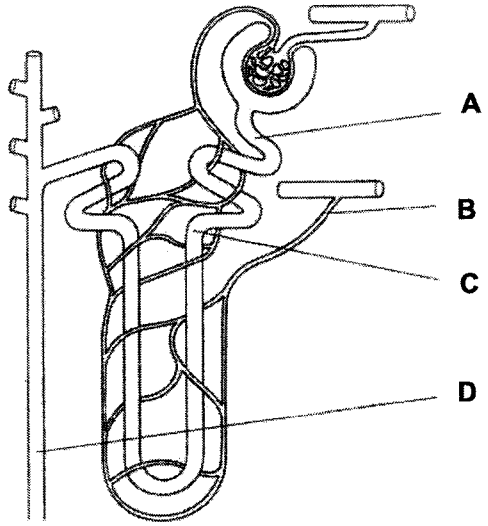
In which regions does the following processes occur?

	selective reabsorption	ultrafiltration
A	X	Y
B	X and Y	Z
C	X and Z	Z
D	Y	X and Z

20 Two samples of fluids were removed from different parts of a kidney tubule for analysis. The results, in arbitrary units, are shown in the table.

chemical	glomerular filtrate	second sample
urea	10	8
sodium ions	10	1
water	100	5
glucose	5	0

From which position was the second sample taken?



21 Drinks, such as coffee, contains caffeine. Caffeine affects the process of hydration because it is a diuretic. This means that it inhibits the production of the ADH hormone at the pituitary gland.

What is the effect of drinking coffee?

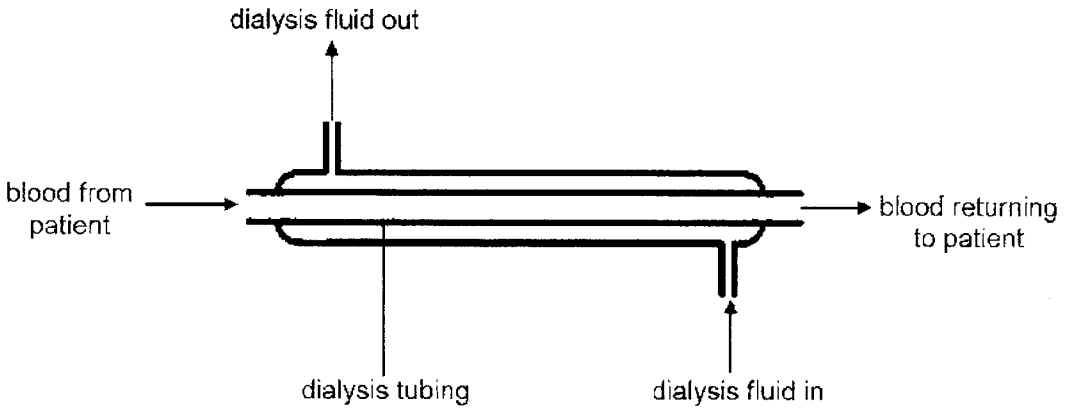
A Larger volume of diluted urine is produced.

B Larger volume of concentrated urine is produced.

C Smaller volume of diluted urine is produced.

D Smaller volume of concentrated urine is produced.

22 An engineer has been asked to improve the efficiency of the dialysis machine shown in the diagram.



The engineer made the following list of recommendations:

1 Increase the length of the dialysis tubing by coiling it.
2 Increase the rate at which dialysis fluid is replaced.
3 Increase the rate at which blood flows into the dialysis machine.
4 Increase the thickness of the dialysis tubing.

Which recommendations will improve the process of dialysis?

A 1 and 2

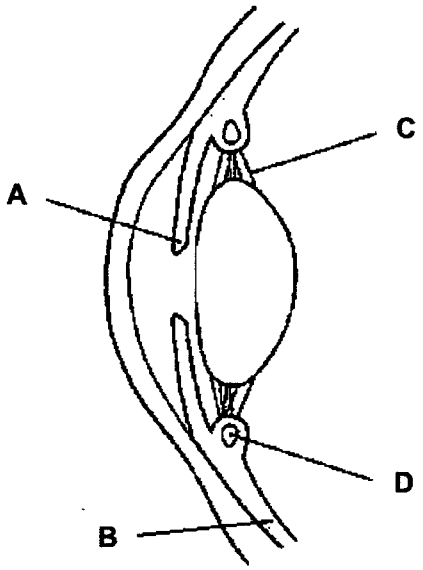
B 1 and 3

C 2 and 3

D 2 and 4

23 The diagram shows a section through a human eye.

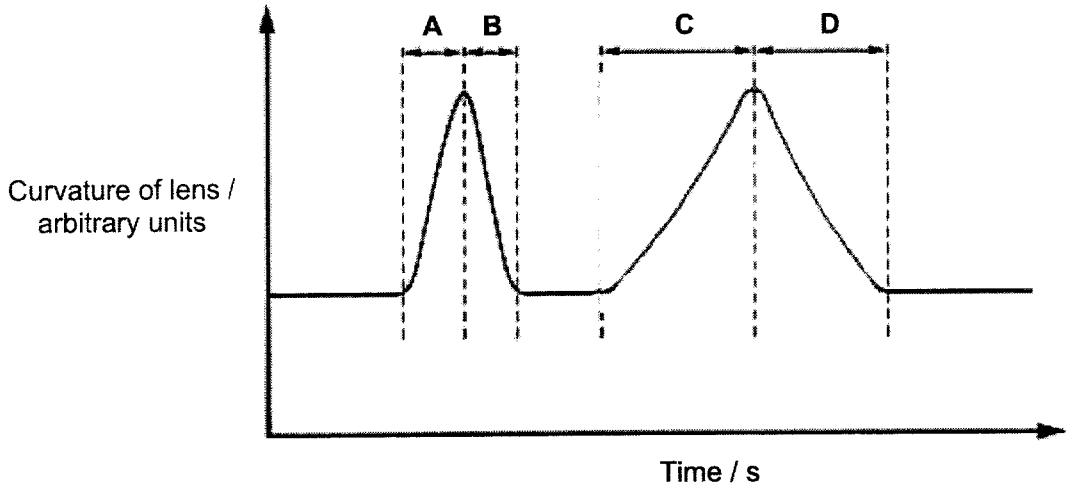
Which structure contains the muscles to protect the eye from being blinded by a bright beam of light?



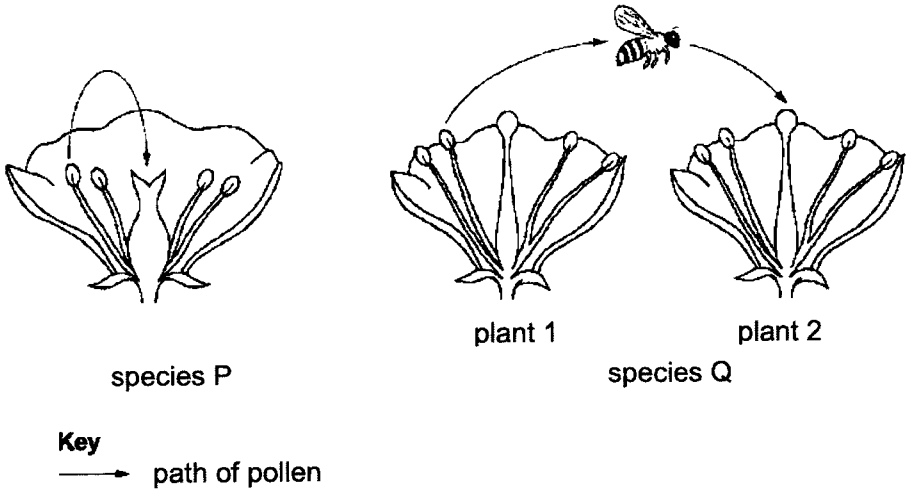
[Turn over

24 The graph shows how the curvature of the lens in a person's eye changes as the person watches two motorbikes go past at different speeds.

During which period was a motorbike moving away from the person at the higher speed?



25 The diagram shows pollination in two different species of flowers.

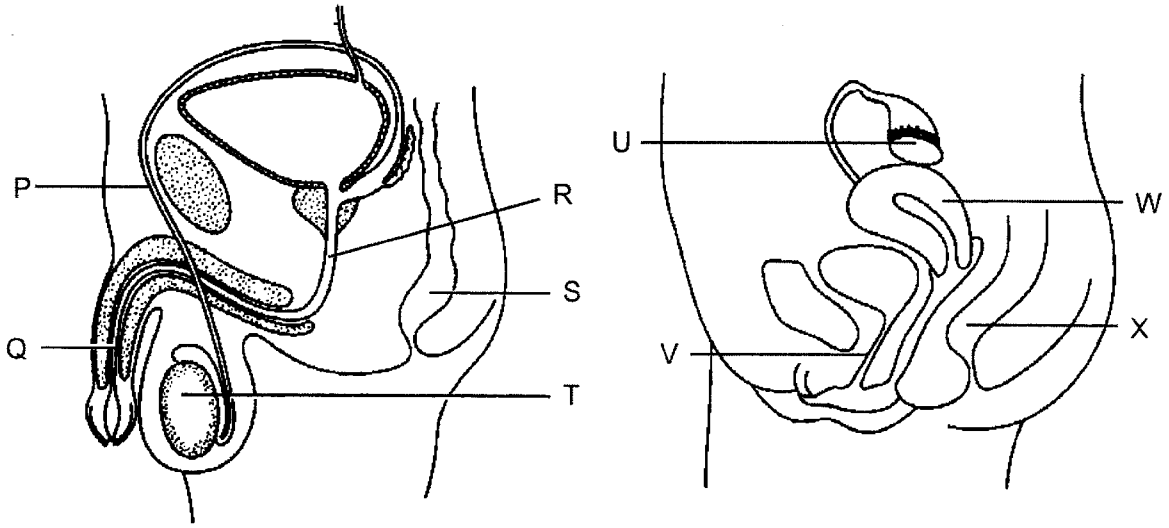


Which of the following classify the mode of pollination and type of reproduction correctly?

	species P		species Q	
	mode of pollination	type of reproduction	mode of pollination	type of reproduction
A	cross	asexual	self	sexual
B	cross	sexual	self	asexual
C	self	sexual	cross	sexual
D	self	asexual	cross	asexual

[Turn over

26 The diagram shows male and female reproductive structures.



Which structures have similar functions?

A Q and U, S and X only

B R and V, T and W only

C S and X, T and U only

D T and W, R and X only

27 Which precautions should be taken to prevent the spread of HIV?

1 avoidance of any direct skin contact with another person
2 medical staff wearing gloves when treating patients
3 not sharing soap used by another person
4 prevent exchange of body fluids
5 treatment of blood products to destroy the virus

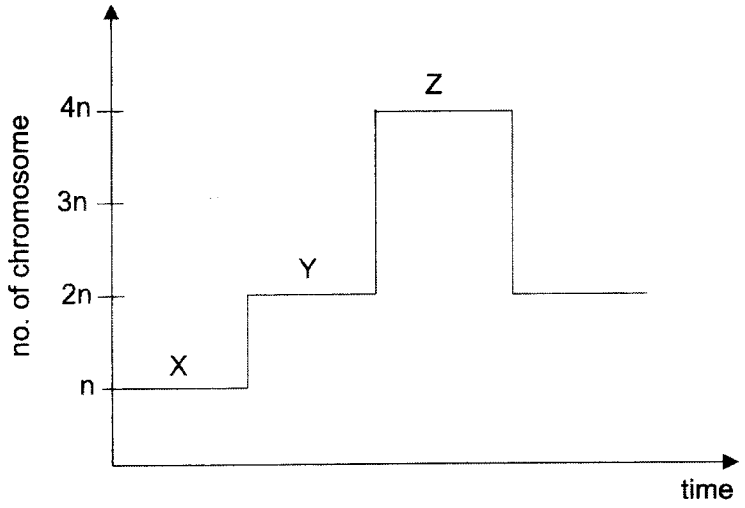
A 1, 2 and 3

B 1, 3 and 4

C 2, 3 and 5

D 2, 4 and 5

28 The diagram below shows changes in the amount of DNA per cell during various events in life.



Which of the following most likely represents X, Y and Z?

	X	Y	Z
A	anaphase I	metaphase I	interphase
B	fertilisation	interphase	telophase
C	gametes formation	fertilisation	interphase
D	telophase	gametes formation	fertilisation

29 Cell division has the following functions.

I asexual reproduction
II growth
III production of enzymes
IV production of gametes
V repair of damaged tissue

Which functions are specific to mitosis?

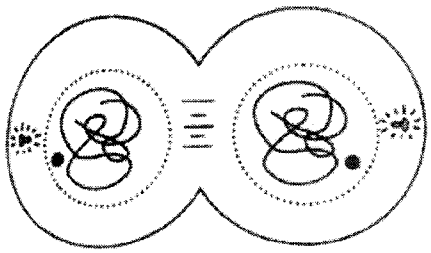
A I, II and IV only

B I, II and V only

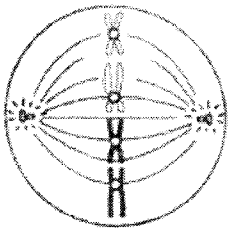
C II, III and IV only

D II, IV and V only

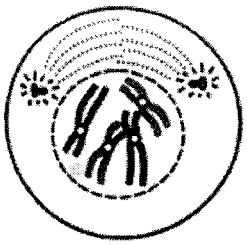
30 The diagram shows some events of a cell cycle taking place in an animal cell. The events are not in the correct sequence.



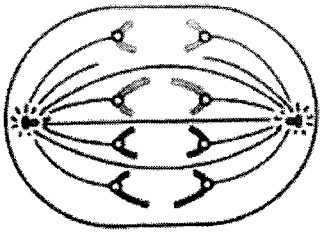
stage I



stage II



stage III



stage IV

Which of the following arranges the events in the correct sequence?

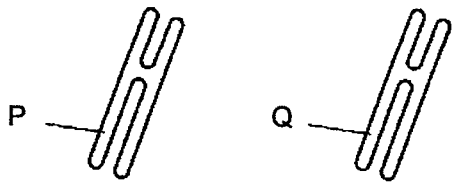
A I, II, IV, III

B II, IV, I, III

C III, II, IV, I

D III, IV, II, I

31 The diagram shows a pair of chromosomes from the same cell. A gene is found at the point labelled P.



In a heterozygous individual, what can be found at the position labelled Q?

A a different allele of a different gene

B a different allele of the same gene

C a different gene of the same allele

D the same gene of the same allele

[Turn over

32 Which statement regarding the structure of DNA is **not** true?

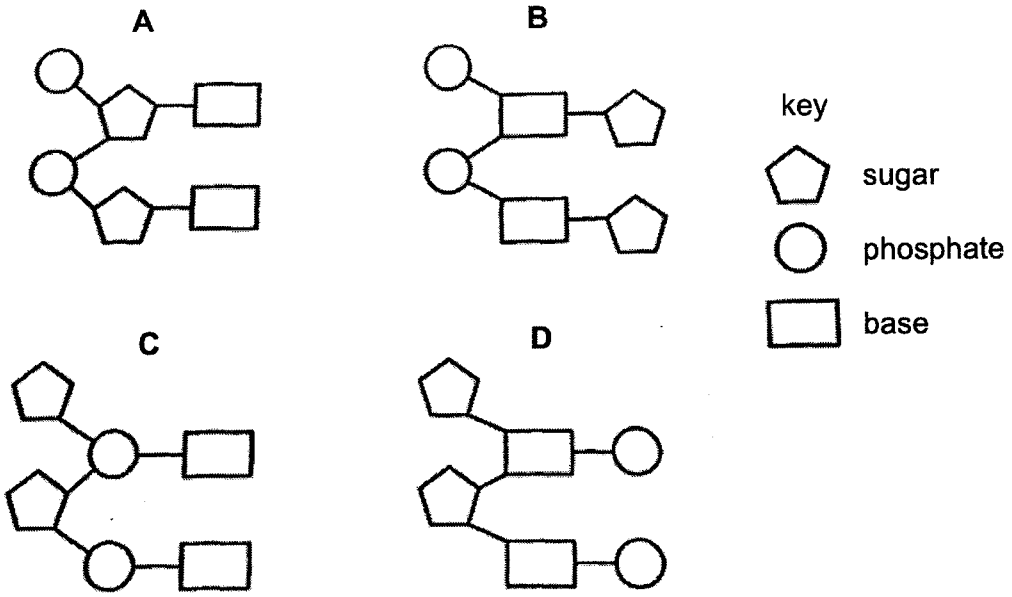
A A DNA molecule has a sugar-phosphate backbone and nitrogenous bases.

B A DNA molecule is made up of nucleotides joined together by peptide bonds.

C DNA consists of two straight anti-parallel strands of polynucleotide chains.

D DNA has 4 bases, which are joined by rule of complementary base pairing.

33 Which diagram shows the structure of two nucleotides in DNA?



34 The table shows the percentage of nucleotides found in a rat and a turtle.

source of DNA	guanine %	thymine %	cytosine %	adenine %
rat	22	28	22	28
turtle	22	28	22	28

Which of the following best explains why the rat and the turtle are different animals despite both having the same percentages of each nucleotide?

A Amino acids are used to produce different proteins in rats and turtles.

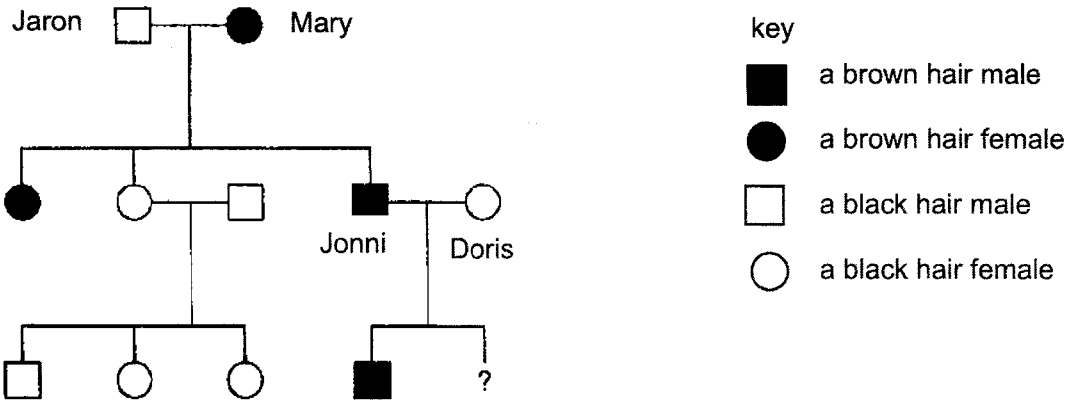
B The deoxyribonucleic acid (DNA) of the rat uses deoxyribose while the DNA of the turtle uses ribose.

C The rules of complementary base pairing are different in rats and turtles.

D The sequence of nucleotides are different and therefore code for different proteins.

[Turn over

Below is a family tree showing the inheritance of brown hair. The allele for brown hair is dominant to the allele for black hair. Use the information to answer questions **35** and **36**.



35 What is the probability of the second child of Jonni and Doris having black hair?

A 0.25

B 0.50

C 0.75

D 1.00

36 The first child of John and Doris is a male. What is the probability of the second child being a female?

A 0.25

B 0.50

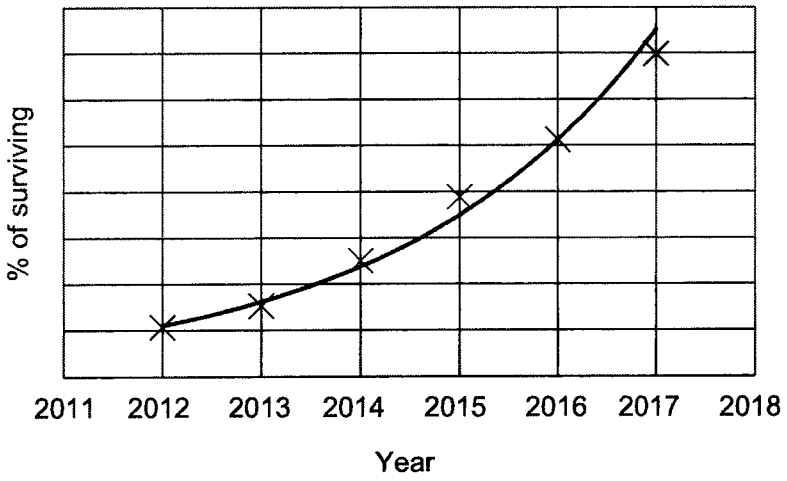
C 0.75

D 1.00

[Turn over

37 A biologist studied the population of rabbits grazing in a grassland. He noticed that some rabbits have longer legs than others. He computed the chances of survival of rabbits with the longer legs over the years.

The graph below shows the results of his study.



Which of the following processes explains the results?

A artificial selection

B genetic engineering

C natural selection

D mutation

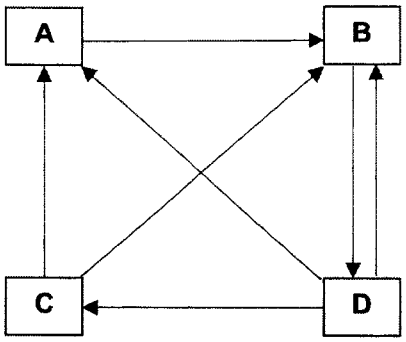
38 How does energy flow through the ecosystem?

	energy enters as	energy is transferred as	energy leaves as
A	chemical	heat	chemical
B	heat	chemical	chemical
C	light	chemical	heat
D	light	heat	chemical

[Turn over

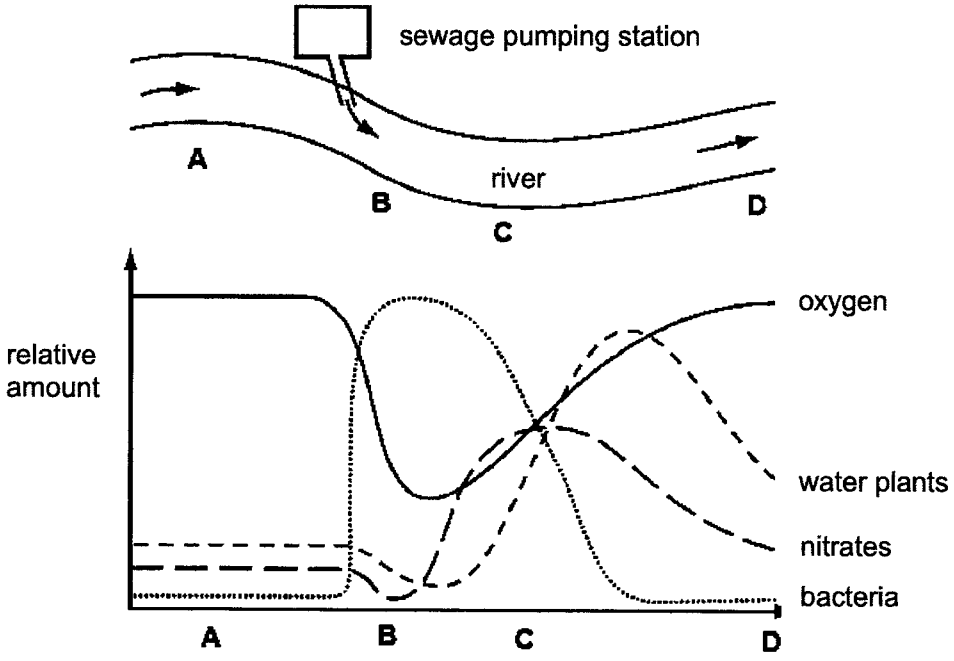
39 The diagram represents the cycling of carbon through the atmosphere, consumers, decomposers and producers in an ecosystem.

Which box represents organisms whose growth rate would be increased by a rise in levels of atmospheric carbon dioxide?



40 The diagram shows part of a river where untreated sewage is being pumped into. Some of the effects of adding sewage to the river are shown in the graph.

At which point in the river are decomposers most active?



End of paper

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JURONGVILLE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2022
Secondary 4 Express

STUDENT NAME

CLASS

INDEX NUMBER

BIOLOGY

6093/02

Paper 2

30 August 2022

1 hour 45 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number in the spaces on all the work you hand in.
Write in dark blue or black pen.
You may use pencil for drawing diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **ALL** questions.
If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
All working must be written step-wise and shown clearly in **INK**.
CAUTION: Any working or answer not written in ink will NOT be marked.

The total marks for this paper is 80.
The number of marks is given in brackets [ ] at the end of each question or part question

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For Examiner's Use	
Section A	50
Section B	
Q7	10
Q8	10
Q9	10
Total	80

Setter: Ms Kay KW

This document consists of **17** printed pages.

Section A: Structured Questions [50 marks]

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

1 Table 1.1 below shows the results obtained from urine samples taken from three different patients, P, Q, and R. Each patient is suspected to be suffering from a damaged organ, which led to different results in Table 2.1.

Table 1.1

patient	glucose	alcohol	haemoglobin
P	present	absent	absent
Q	absent	large amount present	absent
R	absent	absent	present

State a likely condition each of the patients, P, Q and R, is suffering from and provide an explanation for each identified condition.

(a) Patient P

.....

.....

.....

.....[2]

(b) Patient Q

.....

.....

.....

.....[2]

(c) Patient R

.....

.....

.....

.....[2]

[Total: 6]

2 Large trees produce sun leaves on the outside of the canopy where it receives direct sun, and shade leaves inside the canopy where lower leaves are shaded by others. These two types of leaves have some adaptative differences.

(a) With reference to the difference in environmental conditions, suggest an explanation for the following adaptations:

(i) Shade leaves are wider with a larger surface area than sun leaves that are narrow and have a smaller surface area.

.....

.....

.....

.....[2]

(ii) Sun leaves are thicker than shade leaves

.....

.....[1]

(b) Suggest how the sun and shade leaves will differ in terms of stomata size and number.

.....

.....

.....

.....[2]

[Turn Over

2 Fig. 2.1 shows the rate of carbon dioxide uptake or production of a sun leaf and a shade leaf when exposed to increasing light intensity.

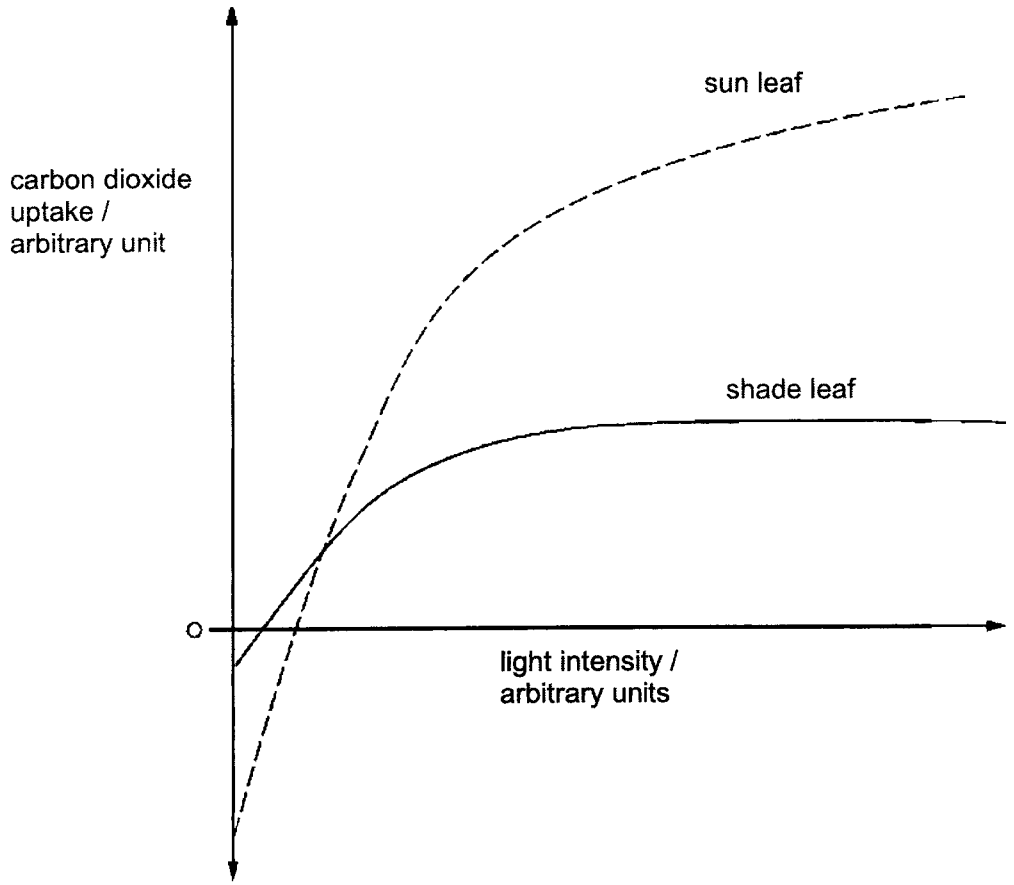

Fig. 2.1

(c) With reference to Fig. 2.1, describe two ways in which the sun and shade leaf differ in their response to increasing light intensity.

.....

.....

.....

.....[2]

(d) Explain why the carbon dioxide uptake does not increase in the shade leaf as light intensity increases.

.....

.....[1]

2 **(e)** The rate of photosynthesis can be calculated based on the biomass of the tree. The tree is able to produce different types of carbohydrates that eventually become a part of its biomass.

Explain, by using two named molecules, how different types of carbohydrates can be produced in the plant.

.....

.....

.....

.....[2]

[Total: 10]

3 Fig. 3.1 shows transverse sections of two types of blood vessel.

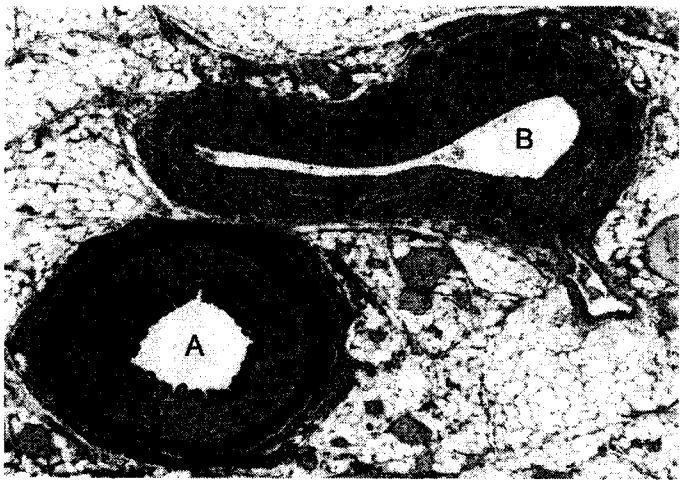

Fig. 3.1

(a) Name the type of blood vessel A and B:

A: .....

B: ..... [2]

(b) State another structural difference between A and B that is not shown in Fig. 3.1.

.....

.....[1]

3 Fig. 3.2 shows the changes in blood pressure and velocity of blood flow as the blood travels from the heart to the leg and returns to the heart.

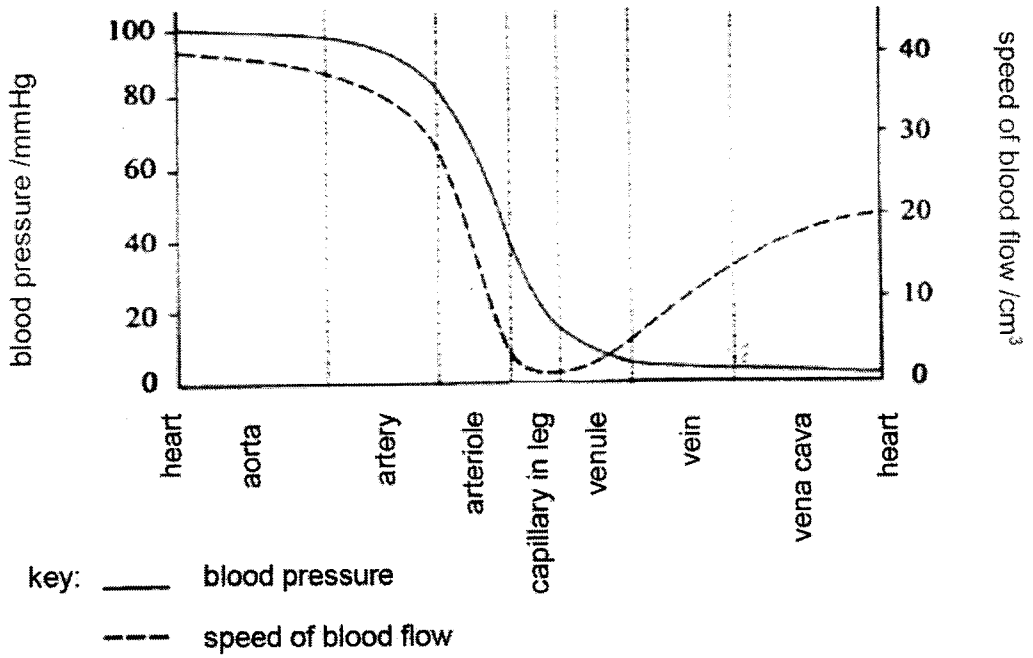

Fig. 3.2

(c) Compare the pressure in the artery with that in the vein. Suggest a reason for the difference.

.....

.....

.....

.....[2]

(d) Explain the importance of the low speed of blood flow in the capillary.

.....

.....[1]

(e) In the vein of the leg, the blood pressure is very low while the speed of the blood flow is quite high. Describe how such a high speed of blood flow in the correct direction is maintained in the vein.

.....

.....

.....

.....[2]

[Total: 8]

4 James was watching a soccer match at a stadium on a sunny afternoon. He felt the vibration of his phone and looked down to check it at the 3rd minute, before returning back to the game at the 7th minutes.

(a) **(i)** In the axis given in Fig. 4.1, sketch a graph, showing changes that are likely to occur to the thickness of her lens during these 10 minutes.

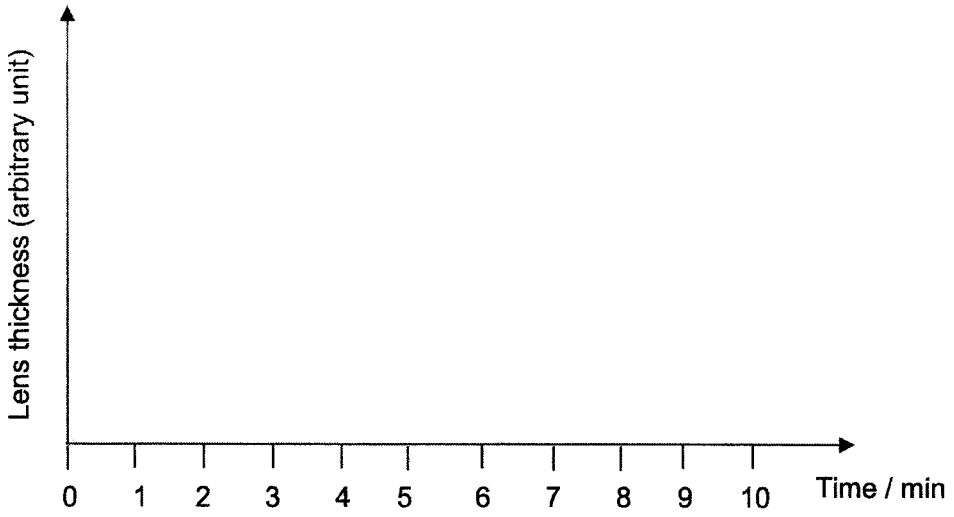

Fig. 4.1

[2]

(ii) Explain your graph in Fig. 4.1.

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.....[4]

[Turn Over

4 (b) (i) In the axis given in Fig. 4.2, sketch a graph, showing changes that are likely to occur to the diameter of her pupil during these 10 minutes.

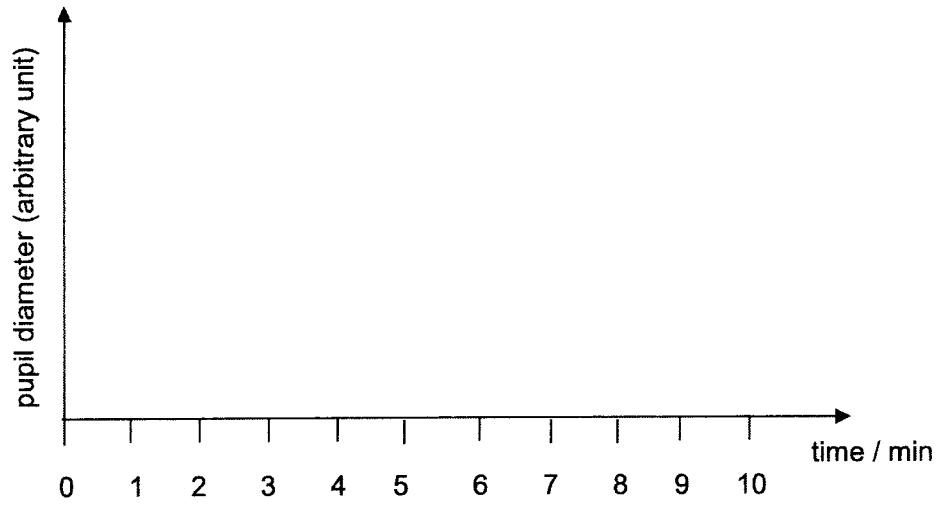

Fig. 4.2

[1]

(ii) Explain your graph in the lines provided below.

.....

.....[1]

[Total: 8]

5 The temperature of the human fetus whilst in the uterus is about 0.5 °C above that of the mother. At birth, the baby emerges into a relatively cool, dry atmosphere. The newborn baby loses heat rapidly and his body temperature can drop about 2 °C within several seconds after birth.

(a) Suggest two possible reasons why the body loses heat rapidly at birth.

.....

.....

.....

.....[2]

(b) Explain how the following help the baby to regulate its temperature:

(i) A layer of subcutaneous fat is developed by the fetus from about the fifth month of pregnancy onwards.

.....

.....[1]

5 **(b)** **(ii)** Blood vessels to the baby's skin constrict very quickly at birth.

.....

.....

.....

.....[2]

(c) It is important to monitor the baby's body temperature and oxygen level closely. It is observed that if skin temperatures drop just one degree from the ideal 36.5 °C, a baby's oxygen use can increase by 10 %.

Explain this observation.

.....

.....[1]

(d) A baby born prematurely is less able to regulate its body temperature and must be kept in an incubator as shown in Fig. 5.1.

Fig. 5.1

A constant temperature is maintained within the incubator using a sensor, thermostat (which is a temperature control centre) and an electric heater.

Use this example of the incubator to explain the meaning of negative feedback.

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.....[3]

[Total: 9]

[Turn Over

6 Fig. 6.1 is a diagram of a human sperm cell.

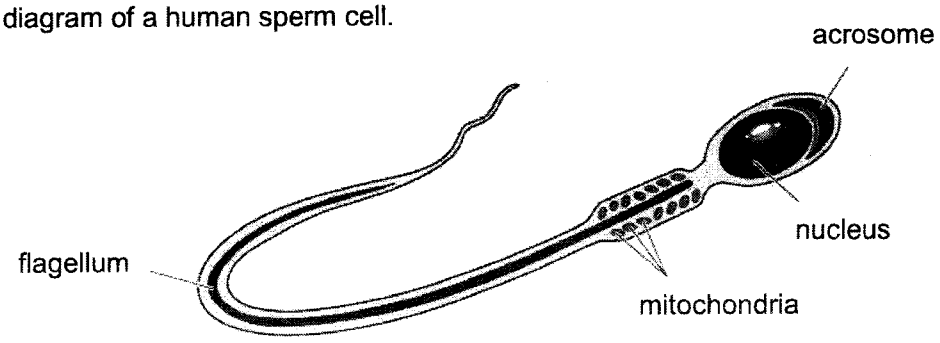

Fig. 6.1

(a) Describe and explain why the nuclei of sperm cells differ from those of other normal body cells in the male.

.....

.....

.....

.....[2]

(b) The nuclei of one sperm may also differ from that of another sperm of the same male. State how they might be different.

.....

.....[1]

(c) **(i)** Identify the organ where sperm is produced.

.....[1]

(ii) State one other function of the organ stated in **(c)(i)**.

.....[1]

6 Fig. 6.2 shows a human fetus developing in the uterus.

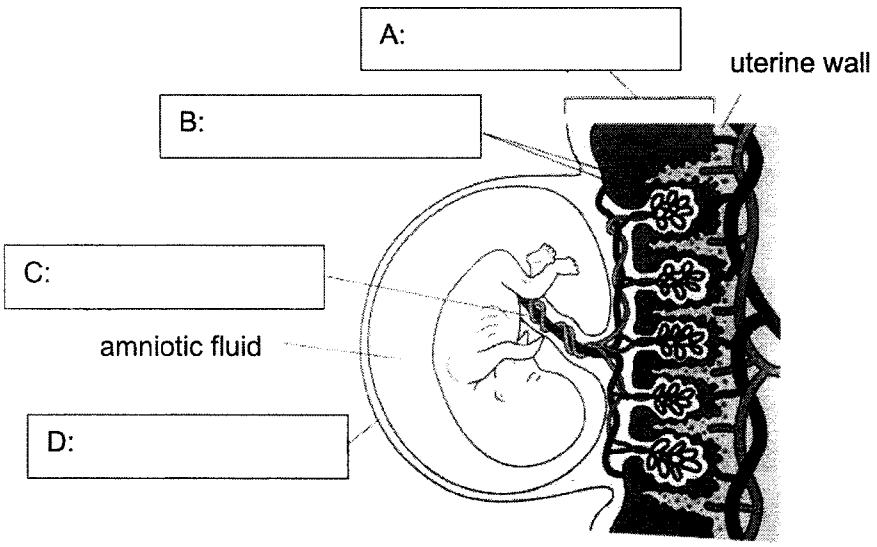

Fig. 6.2

(d) Label the structures A – D in Fig. 6.2. [2]

(e) Describe how structure A ensures healthy growth of the fetus.

.....

.....

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.....[2]

[Total: 9]

[Turn Over

Section B (30 marks)
Answer **all three** questions.

7 Fig. 7.1 shows a pollen grain with a pollen tube growing from it.

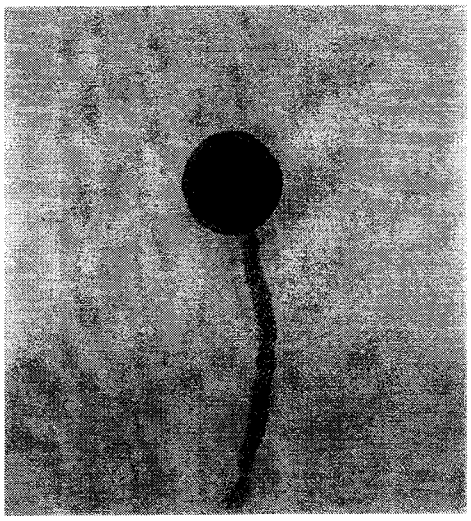

Fig 7.1

Pollen grains from the same type of plant were placed in sucrose solutions of different concentrations for a fixed amount of time. After this time, the pollen grains and tubes were examined using a microscope. The following observations were made for each concentration of sucrose:

- the number of pollen grains that had germinated to produce a pollen tube,
- the length of each pollen tube.

Table 7.1 shows the results of investigation.

Table 7.1

% sucrose concentration	% pollen grain germinated	mean pollen tube length / mm
1	6	0.005
2	13	0.008
4	25	0.015
8	56	0.040
10	31	0.030
20	25	0.018
40	13	0.006

(a) **(i)** A total of 12 pollen grains were placed in 20% sucrose solution.

Use the information in the table to calculate the number of pollen grains that germinated to produce a pollen tube in the 20% sucrose solution.

.....[1]

7 (a) (ii) Suggest why the mean pollen tube length was calculated for each sucrose concentration.

.....

.....[1]

(iii) Using the information in Table 7.1, suggest the optimum concentration of sucrose solution for the pollen tube germination and growth. Explain your answer.

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.....

.....

.....[2]

(iv) The germination of the pollen tube requires the movement of water from the surrounding into the pollen grains.

Suggest why placing a pollen grain in a solution with a higher sucrose solution than in your answer to **(a)(iii)** may result in a lower percentage of germination.

.....

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.....[2]

(b) Describe the route taken by a growing pollen tube in a plant and explain its importance in plant reproduction.

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.....[4]

[Total: 10]

[Turn Over

8 **(a)** In conditions of prolonged exposure to extreme cold temperatures (e.g. below 0 °C), frostbite occurs and the person may feel complete loss of sensation in the fingers and toes. Explain how this happens.

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.....[5]

(b) "The Braille system is a method that is widely used by the blind to read and write. Each Braille character is made up of dots which are raised on the surface of paper and a blind person can read by touching the raised dots."

Outline the nervous pathway which allows this to happen.

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.....[5]

[Total: 10]

EITHER

9 (a) Discuss the different processes that can lead to variation in organisms:

(i) Meiosis

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.....

.....[2]

(ii) Fertilisation

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.....

.....[2]

(iii) Mutation

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.....

.....[2]

(b) Explain how natural selection can lead to evolution.

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.....[4]

[Total: 10]

[Turn Over

OR

9 Fig. 9.1 below shows a number of organisms living together.

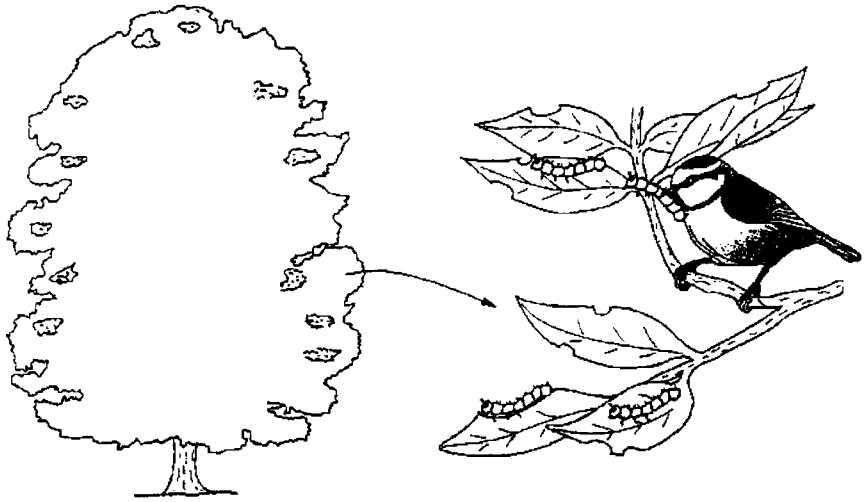

Fig. 9.1

(a) **(i)** The birds in the habitat become severely infected by fleas (parasites). Draw a detailed pyramid of numbers and pyramid of biomass below for this habitat.

Pyramid of numbers:

Pyramid of biomass:

[3]

(ii) Explain why the shape of the two pyramids differ.

.....

.....

.....

.....[2]

9 **(b)** For the past few weeks, a farm has attempted to increase its output of crops by spraying the crops with the pesticide DDT and fertilising the soil with high-nitrogen and phosphate chemical fertilisers.

Predict and explain what might happen to the organisms in a river located near to the farm during the next few months.

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.....[5]

[Total: 10]

END OF PAPER

Jurongville Secondary School
Science Department 2022
Marking Scheme & Marker's Report

Assessment: Preliminary Examination 4E Biology (6093) **Level:** 4 Express

Qn	Marking Scheme	Remarks	Marks	Marker's Report
1	B		[1]	
2	C		[1]	
3	B		[1]	
4	C		[1]	
5	D		[1]	
6	C		[1]	
7	A		[1]	
8	C		[1]	
9	B		[1]	
10	B		[1]	
11	C		[1]	
12	A		[1]	
13	D		[1]	
14	C		[1]	
15	C		[1]	
16	D		[1]	
17	D		[1]	
18	D		[1]	
19	C		[1]	
20	D		[1]	
21	A		[1]	
22	A		[1]	
23	A		[1]	
24	B		[1]	
25	C		[1]	
26	C		[1]	

[Turn over

Qn	Marking Scheme	Remarks	Marks	Marker's Report
27	D		[1]	
28	C		[1]	
29	B		[1]	
30	C		[1]	
31	B		[1]	
32	C		[1]	
33	A		[1]	
34	D		[1]	
35	B		[1]	
36	B		[1]	
37	C		[1]	
38	C		[1]	
39	D		[1]	
40	B		[1]	

[Turn over

Jurongville Secondary School
Science Department 2022
Marking Scheme & Marker's Report

Assessment: Mid-Year Sec 4 Express Pure Biology 6093 **Level:** Sec 4E

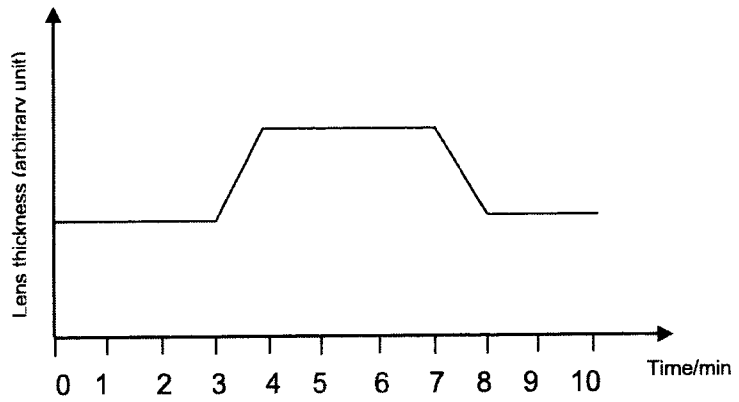
Qn	Marking Scheme	Remarks	Marks	Marker's Report
Section A				
1a				
1b				
1c				
2ai				
2aii				
2b				

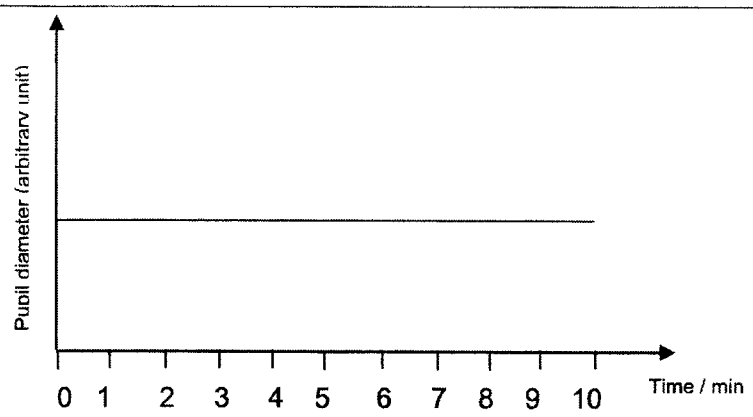
Jurongville Secondary School
Science Department 2022
Marking Scheme & Marker's Report

Assessment: Prelim Sec 4 Express Pure Biology 6093 **Level:** Sec 4E

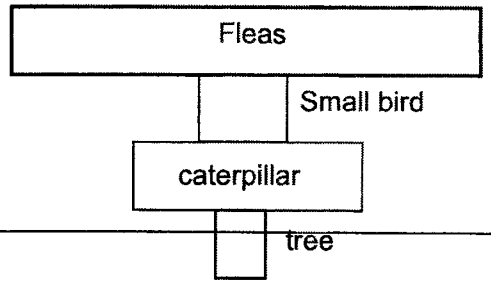
Qn	Marking Scheme	Remarks	Marks
1	B		
2	C		
3	B		
4	C		
5	D		
6	C		
7	A		
8	C		
9	B		
10	C		
11	C		
12	A		
13	D		
14	C		
15	C		
16	D		
17	D		
18	D		
19	C		
20	D		
21	A		
22	A		
23	A		
24	B		
25	C		
26	C		
27	D		
28	C		
29	B		
30	C		
31	B		
32	C		
33	A		
34	D		
35	B		
36	B		
37	C		
38	C		
39	D		
40	B		
			25m

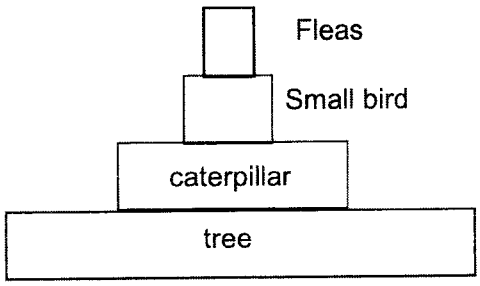
Qn	Marking Scheme	Remarks	Marks
1a	1. Patient is suffering from diabetes mellitus/ damaged islets of Langerhans/damaged pancreas 2. The inability to release insulin results in high blood glucose level in the body, which may not be absorbed during selective reabsorption in the proximal convoluted tubule of the nephron. Thus, glucose is present in urine		1 1
1b	1. Patient is suffering from liver failure; / Patient is intoxicated / liver cirrhosis; 2. The patient was unable to produce enzyme/alcohol dehydrogenase to break down alcohol.		1 1
1c	1. Ruptured glomerulus /basement membrane/ kidney failure; 2. As a result of the ruptured structure, red blood cells are able to pass through into the nephron tubules. As such, red blood cells found excreted through urine will show presence of blood.		1 1
2ai	Any 2 points: 1. Sun leaves are exposed to more heat and / or wind in their exposed locations, The smaller surface area of sun leaves protects against wilting; 2. Sheltered locations of shade leaves guard against water loss; Shade leaves expand in size to collect as much light energy as possible.	Accept any logical answer.	1 1
2ai i	Sun leaves develop longer palisade cells or an additional layer of palisade cells / thicker layer of cuticle to protect the sun from evaporation; [reject more cells.]	Accept any logical answer. Rej.: more cells.	1
2b	1. Stomata pores of sun leaves are smaller, but are greater in number. 2. Stomata pores of shade leaves are larger, but much fewer in number.	Ans must compare both number and size.	1 1
2c	Any two of the following: 1. At low light intensity, the shade leaf took in carbon dioxide at a higher rate than the sun leaf. 2. As light intensity increases, the shade leaf does not take in more carbon dioxide but the sun leaf continues to take in more carbon dioxide. 3.The sun leaf is able to take in twice as much of carbon dioxide compared to the shade leaf at high light intensities.		2
2d	As the light intensity increases, light intensity no longer is a limiting factor for the shade leaf;		1
2e	Glucose is formed as a product of photosynthesis. AND Any 2 of the following:	Max [1] if glucose is not mentioned as end product.	 2

Qn	Marking Scheme	Remarks	Marks
	1. It can be converted to **cellulose**, a polysaccharide used for the production of cell walls of plant cells. 2. Glucose can be converted to **sucrose** to be transported via translocation through the phloem to other parts of the plant for storage. Glucose can be converted to **starch** to be stored within the plant cells (as granules) to be used as an energy store.		
			10m
3a	A: artery / arteriole B: vein / venule		1 1
3b	Semilunar valves are absent in A but present in B;		1
3c	Higher pressure in artery than in vein; Any 1 reason: • Thicker and more elastic muscle wall retain recoil effect whereas veins has thinner elastic muscular wall; OR • Constant contraction of (left) ventricular muscle maintains high pressure in the artery, unlike veins which are far distance to from the heart to have any high pressure;		1 1
3d	**Increase** time / provide **sufficient** time for exchange of substances (between blood in capillaries and tissue fluid);		1
3e	1. Muscle contraction of leg surrounding the vein ensures high speed of blood flow; 2. Presence of valves in the vein ensures the blood flow is moving in the same direction;		1 1
			8m
4ai	[1] for increasing thickness at 3 min [1] for decreasing thickness at 7 min  		2
4ai i	1. When he looks at the handphone in his hand at t=3min, the ciliary muscles of the eye will contract, relaxing the pull on the suspensory ligament; 2. Suspensory ligament slacken, relaxing the pull on the lens; 3. This would cause the lens to become thicker and more convex (decreasing the focal length) to allow it to focus on a near object 4. [overall [1] for describing the opposite events correctly] • At t=7min, as she looks back at the soccer game, the ciliary muscles will relax, pulling on the suspensory ligament; • Suspensory ligaments become taut, pulling on the edge of the lens.		1 1 1 1

Qn	Marking Scheme	Remarks	Marks
	• This would cause the lens to become thinner and less convex (increasing the focal length), allowing it to focus on a far object.		
4b i			1
4b ii	Light intensity remains the same throughout, hence there would be no alteration of the diameter of the iris.		1
			8m
5a	1. The room temperature is much cooler compared to mother's womb / uterus / body; 2. As amnionic fluid **evaporates** from the skin surface, **latent heat of vaporisation** is lost;	[1] for comparing temperature difference [1] mode in which heat is lost	1 1
5b i	Fat is an insulator against heat loss when it is expose to a colder environment		1
5b ii	1. To reduce blood flow to the skin capillaries 2. So as to minimize heat loss by radiation, convection and conduction (mention at least once mode of heat loss)	Reject, prevent excessive loss of heat	1 1
5c	New born baby uses the oxygen to increase metabolic reactions / respiration to generate energy and heat.		1
5d	1. When an increase in temperature is detected by a sensor; 2. The thermostat will off the heater; 3. Causing less heat to be released and thus counteract change / brings about opposite effect to the change to return temperature to norm;	(vice versa)	1 1 1
			9m
6a	1. (describe) The sperm is a haploid cell after going through meiosis, while somatic cells are diploid; 2. (explain) So that when the sperm fertilises the egg, the number of chromosomes in the zygote remains / restored to the same as the other cells and does not double		1 1

Qn	Marking Scheme	Remarks	Marks
6b	Some sperm contains X chromosomes while others contain Y chromosomes.		1
6ci	Testis / testes	Reject spelling error	1
6ci i	Secrete mal sex hormones, **testosterone**.		
6d	A: placenta B: (embryonic) villi / fetal capillaries C: umbilical cord D: amniotic sac	[1] for any 2 correct. Rej. Spelling error	2
6e	Any two: 1. It allows **oxygen and dissolved substances** (such as glucose, amino acids and mineral salts) to diffuse from the mother's blood into the fetal blood; 2. It allows **metablic waste or excretory proudcts** (such as urea and carbon dioxide) to diffuse from the fetus's blood into the mother's blood; 3. It allows **protective antibodies**, which protect fetus against diseases, to diffuse from the mother's blood into the fetal blood; 4. It produces **progesterorne** which maintains the uterine lining in a healthy state during pregnancy;	OWTTE Allow e.c.f	2
Section B			
7ai	Number of pollen grains that germinated = (25/100) x 12 OR 12/4 = 3 pollen grains		1
7ai i	Any one: some may not germinate / some may not produce a pollen tube ; accuracy / precision / reliability / validity / reduce error ;	Accept other logical answer.	1
7ai ii	8 % sucrose concentration; highest % of pollen grain germinated and **highest** mean pollen tube length;		1 1
7iv	1. Higher sucrose solution have lower water potential; 2. When the water potential of the solution is lower than the cytoplasm of pollen tube, less or no water molecules enters the pollen tube by osmosis. Hence stopping / hindering germination.	Reference to water "molecules"	1 1
7b	Route taken: 1. Germination of pollen tube occurs in the stigma, and it grow down the style towards the ovary; 2. Pollen tube enters the ovule through micropyle; Importance: 3. Pollen tube allows the movement of male gametes; 4. And releases the gametes into the ovules where nucleus of one male gametes fuses with the nucleus of the ovum to form the zygote during fertilization;		1 1 1 1
			10m

Qn	Marking Scheme	Remarks	Marks
8a	1. arterioles constricting, less blood flow to blood capillaries in skin; 2. reduce blood flow to the skin to prevent heat loss; 3. oxygen supply to skin reduced; 4. ice crystals in spaces around the cells; 5. cause cell death and destruction of cells in fingers and toes;		1 1 1 1 1
8b	1. When the blind person touches the raised marks on the surface of paper, the nerve endings of the touch receptors in the skin are stimulated; 2. Nerve impulses produced travel along the **sensory neurone to the spinal cord**; 3. and then through a synapse **to the relay neuron** in the spinal cord; 4. Electrical impulses travel through the relay neuron **to the brain**; 5. where the **brain will interpret the electrical impulses** as touching the raised marks.		1 1 1 1 1
			10m
9E ai	1. **Crossing over during prophase I**, which result in new combination of existing alleles along the chromosomes, and 2. **independent assortment during metaphase I**, where homologous chromosomes randomly align along the metaphase plate / equatorial plate; 3. (during meiosis) produce gametes that are **not genetically identical** to each other or to parent cells.	Any 2	1 1
9E aii	1. Fertilisation involves the **fusion of random gametes** 2. that carry **different alleles** for different genes from each parent / Each gamete is genetically dissimilar and haploid;		1 1
9E aii	1. Error can occurs during the **replication** of the gene or chromosome; 2. Mutation leads to random change in structure of gene or the number of chromosome;		1 1
9E b	1. In the presence of selection pressures such as **competition for food** or **predators**, **favourable traits** will confer a **selective advantage**. / nature selects varieties that are more competitive, more resistant to diseases and better adapted to changes in environment 2. Allowing those individuals to **survive and reproduce** 3. Causing most of the population to be of **individuals with the favorable trait** / individual with favorable trait becomes the predominant species in their environment. 4. Other individuals that are susceptible to diseases or environmental changes may gradually die off.		1 1 1 1
			10m
9O ai	**Pyramid of numbers**  	[1] for each correct shape of the pyramids [1] both pyramids with correct labels	3

Qn	Marking Scheme	Remarks	Marks
	Pyramid of biomass  	Deduct [1] for not using ruler and / or pencil	
9O aii	1. In the pyramid of numbers, many small caterpillars are able to feed on one large tree, and one bird can be infected by many fleas; 2. However, one tree and one bird will have a comparatively large biomass to support the caterpillar and fleas respectively;		**1** **1**
9O b	1. Pesticides and fertiliser will enter the water bodies when it is washed down by rain or through underground water; 2. Pesticides like DDT may be ingested by the organisms and may not or may not be easily excreted out of organism. This will cause **bioaccumulation** of DDT in the organisms; 3. and up the food chain where its toxic effects will **amplify** and harm or kill the top consumer **(bioamplification)** ; 4. The high-nitrogen fertiliser released into the river will lead to the profuse growth of algae and water plants leading to **eutrophication**; 5. This will lead to lack of sunlight for submerged plants, causing them to die and multiplication of bacteria in the waters, and depletion in dissolved oxygen, resulting in death or other organisms like the fish; [1m for effects: esp of the immediate ones like death of submerged plants]		**1** **1** **1** **1** **1**