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JURONGVILLE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2020
Secondary 4 Express

STUDENT NAME			
CLASS		INDEX NUMBER	

BIOLOGY

6093/01

Paper 1

31 AUGUST 2020

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

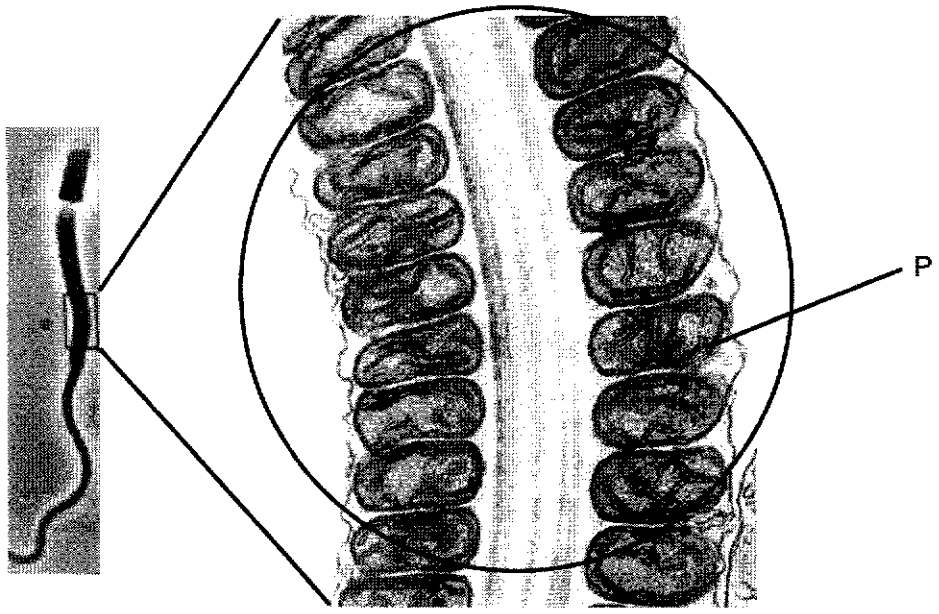
For Examiner's Use
40

Setter: Ms Jo-Ann Lee Hui

This document consists of **16** printed pages.

[Turn over

1 Figure X shows a sperm cell and figure Y shows the magnified view of a portion of the sperm cell.



X Y

The sperm cell contains numerous structure P to aid in its movement towards the ovum.

What is P?

A deoxyribonucleic acid

B mitochondrion

C ribosome

D rough endoplasmic reticulum

2 Tay-Sachs disease occurs when cells are unable to produce an enzyme, leading to a build-up of certain lipids in cells.

Which cell structure is **not** functioning correctly, resulting in this disease?

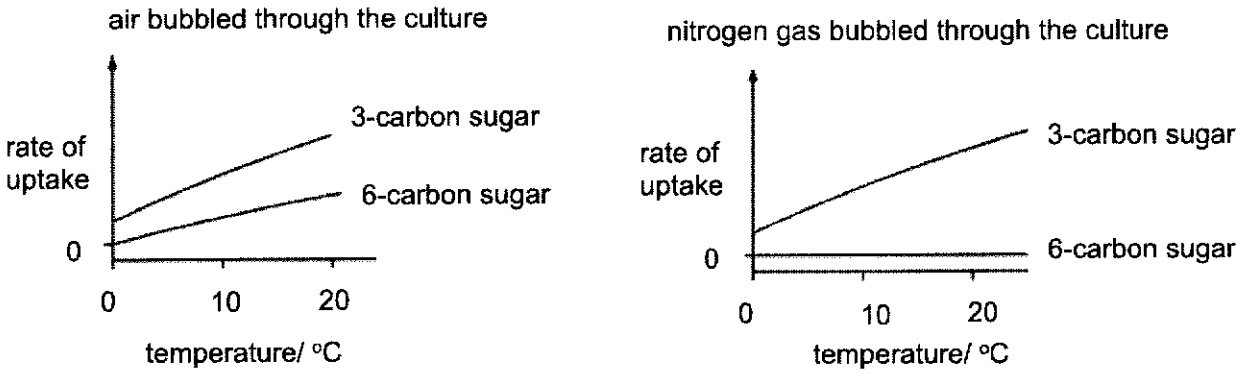
A lysosome

B mitochondria

C rough endoplasmic reticulum

D vacuole

3 The graphs show the rate of uptake of sugars by a culture of animal cells, under different conditions.

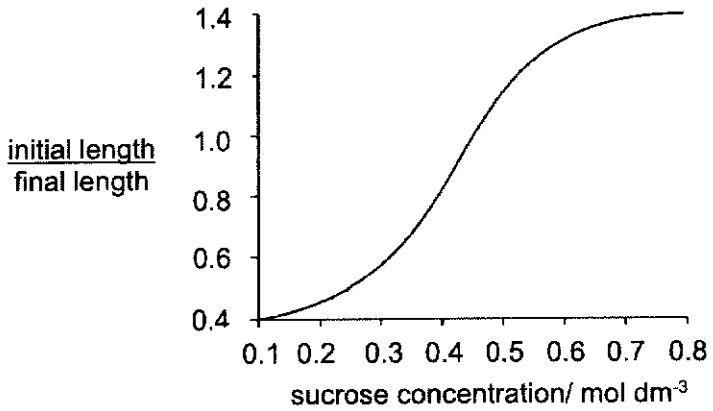


Which of the following correctly identifies how the sugars are taken up by the cells when air is bubbled through the culture?

	3-carbon sugar	6-carbon sugar
A	active transport	active transport
B	active transport	diffusion
C	diffusion	active transport
D	diffusion	diffusion

4 Strips of celery of the same length were soaked in sucrose solutions of different concentrations. After 30 minutes, the lengths of the celery strips were measured.

The graph below shows the ratio of initial length to final length of the celery against sucrose concentration.



Which concentration of sucrose solution has the same water potential as the cell sap of the celery?

A 0.10 mol dm^{-3}

B 0.30 mol dm^{-3}

C 0.45 mol dm^{-3}

D 0.75 mol dm^{-3}

[Turn over

5 Food tests were carried out on a liquid sample containing sucrose and protein only.

Which of the following shows the correct results obtained?

	Benedict's test	Biuret test	iodine test
A	blue	purple	blue-black
B	blue	purple	brown
C	brick-red	blue	brown
D	brick-red	purple	brown

6 Cubes of hard-boiled egg white are placed in test-tubes containing different combinations of chemicals added.

tube	chemical(s) added	result of test for amino acids
1	pepsin	absent
2	pepsin + alkali	absent
3	none	absent
4	pepsin + acid	large amounts
5	boiled pepsin + acid	traces
6	acid	traces
7	alkali	absent

Which tubes show that pepsin is an enzyme?

A 1 and 6

B 2 and 7

C 4 and 5

D 5 and 6

7 Why is light energy required for photosynthesis?

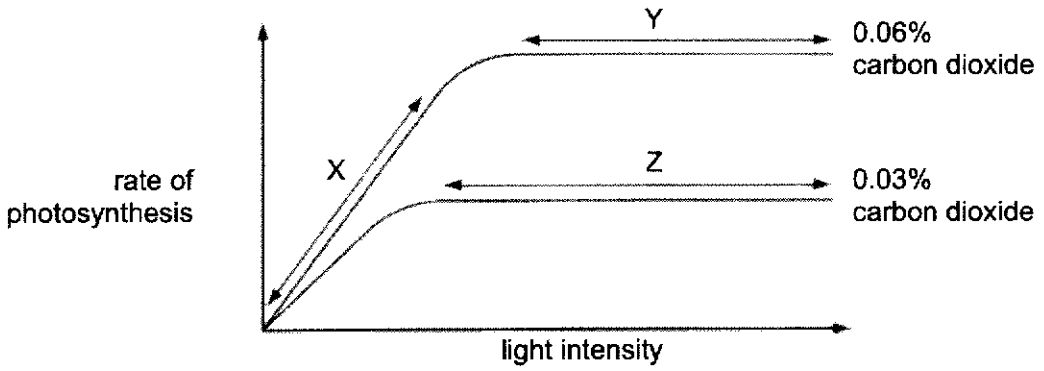
A It is a catalyst.

B It activates enzymes.

C It breaks down water molecules.

D It helps to form chlorophyll.

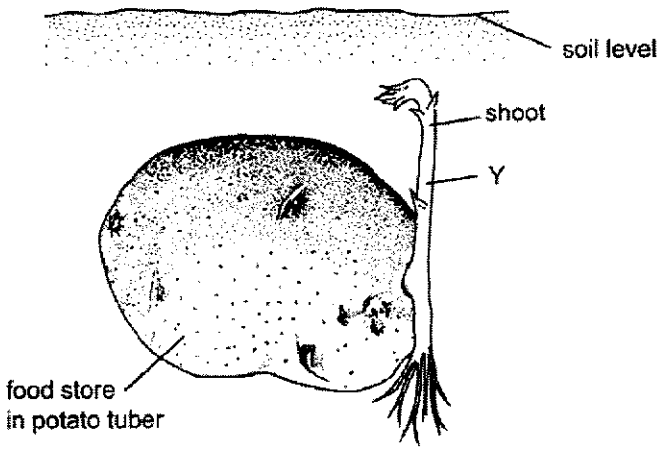
8 The graph shows the rate of photosynthesis of a plant at increasing light intensities at two carbon dioxide (CO_2) concentrations. The temperature is kept constant.



What may be limiting the rate of photosynthesis at X, Y and Z?

	X	Y	Z
A	CO_2 concentration	light intensity	CO_2 concentration
B	CO_2 concentration	light intensity	light intensity
C	light intensity	light intensity	CO_2 concentration
D	light intensity	CO_2 concentration	CO_2 concentration

9 The diagram shows a shoot growing from a potato tuber.



What is being transported in the phloem cells at Y?

A starch downwards

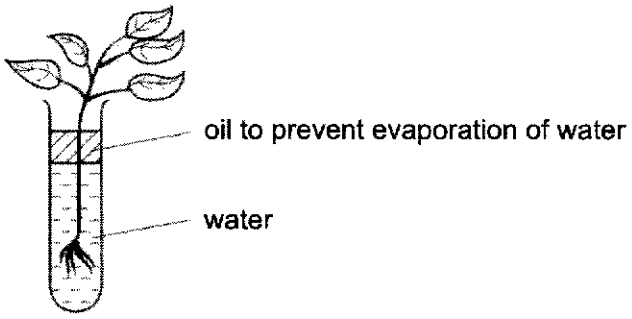
B starch upwards

C sucrose downwards

D sucrose upwards

[Turn over

10 In an investigation into the rate of transpiration, five of the following set-ups were used.



Some of the plants had all their leaves coated with grease to reduce transpiration. Each plant is weighed in its own test-tube at the start of the experiment and after two days.

The results are shown in the table.

	mass of plant / g				
	plant 1	plant 2	plant 3	plant 4	plant 5
start of experiment	105	121	107	111	119
after 2 days	103	97	84	110	93

Which plants had their leaves coated with grease?

A 1 and 4

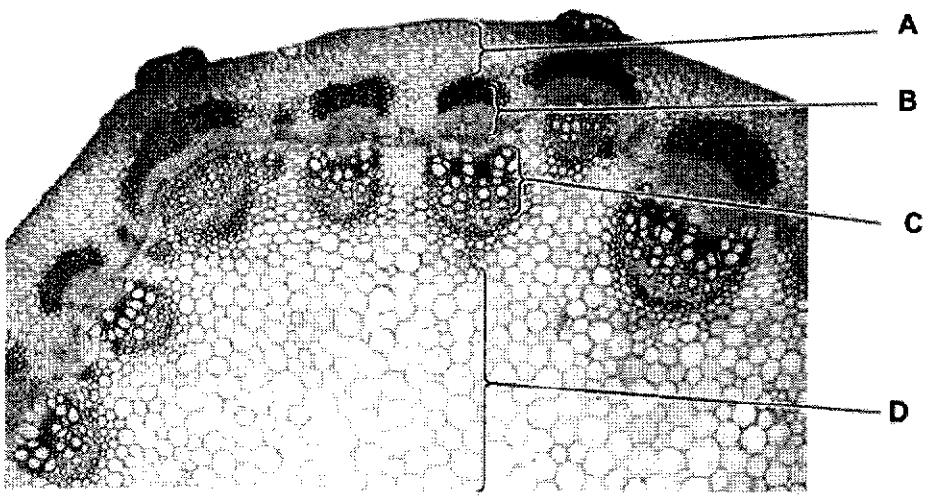
B 1 and 5

C 2 and 4

D 2, 3 and 5

11 The photomicrograph shows part of a cross-section of a plant stem.

Which structure contains companion cells?



12 Blood from the ileum is carried in the hepatic portal vein to the liver.

Why is this an advantage to the body?

A Amino acids can be converted to urea before they enter the general circulation.

B Excess glucose can be converted to glycogen for storage and not excreted.

C Ensures that fat products pass through the liver before they reach the heart.

D Toxic materials can be destroyed before they reach any body cells.

13 Samples of digestive juices obtained from three patients' small intestines were tested for the presence of fats. The conditions faced by each patient is shown below.

	patient 1	patient 2	patient 3
pancreatic duct blocked	no	yes	yes
bile duct blocked	no	no	yes

Which of the following shows the most probable results from the test for the presence of fats?

	patient 1	patient 2	patient 3
A	negative	positive	positive
B	positive	positive	negative
C	positive	negative	positive
D	negative	negative	positive

14 Cardiac muscle is made up of many muscle fibres that form the walls of the chambers of the heart.

When the heart contracts, these muscle fibres shorten in length so the muscle creates a force that exerts a pressure on the blood, causing it to move.

Which statement explains the difference in thickness of the walls of ventricles of the heart?

A The number of muscle fibres in the left ventricle is greater than the number in the right ventricle so their contraction has more force, exerting more pressure on blood.

B The space available to fill with blood inside the left ventricle is smaller than that of the right ventricle so more pressure is needed to force blood out.

C The wall of the right ventricle is thicker than that of the left ventricle because it has to resist more pressure when the muscle of the right ventricle contracts.

D There is more muscle in the wall of the right ventricle than that of the left ventricle because more pressure is needed to push blood into the aorta than into the pulmonary artery.

15 Police officers can gain genetic information about criminals by collecting samples of blood from the crime scene. The information is analysed and compared to data they have.

Which component of blood would help the police in their analysis?

A plasma

B platelets

C red blood cells

D white blood cells

16 The table shows the results of blood tests of three volunteers, P, Q and R for blood transfusion.

		donor		
		P	Q	R
recipient	P		agglutination	no agglutination
	Q	no agglutination		no agglutination
	R	agglutination	agglutination	

Which of the following may be the blood types of volunteers P and Q?

	P	Q
A	A	AB
B	A	O
C	B	B
D	O	AB

17 Approximately 13.8% of people infected with the Covid-19 virus suffer from pneumonia. Pneumonia is an infection of the alveoli resulting in inflammation. This causes the alveoli to be filled with pus, resulting in cough with phlegm, fever and breathing difficulty.

Which of the following would best explain the breathing difficulty experienced in pneumonia?

A There is a decrease in blood flow to the lungs.

B There is a decrease in elasticity of the lungs.

C There is blockage of alveoli in the lungs.

D There is breakdown of the alveolar walls.

18 What describes the role of carbonic anhydrase in the removal of carbon dioxide from the body?

A It causes red blood cells to absorb carbon dioxide.

B It causes the formation of hydrogencarbonate ions in the red blood cells.

C It decreases the diffusion of carbon dioxide through the alveolar membrane.

D It decreases the release of carbon dioxide from mitochondria.

19 Some of the effects of smoking are listed.

1 It causes coughing.
2 It decreases the transport of oxygen.
3 It increases blood pressure.
4 It increases the risk of cancer.
5 It prevents cilia from moving.

Which components of tobacco smoke cause these effects?

	tar	carbon monoxide	nicotine
A	1 and 5	3 and 5	4
B	3 and 4	1, 2 and 5	2 and 4
C	1, 3 and 4	2	4 and 5
D	1,4 and 5	2	3

20 Which of the following is true of anaerobic respiration?

	product(s)	amount of energy released
A	lactic acid only	small
B	lactic acid only	large
C	lactic acid and carbon dioxide	small
D	lactic acid and carbon dioxide	large

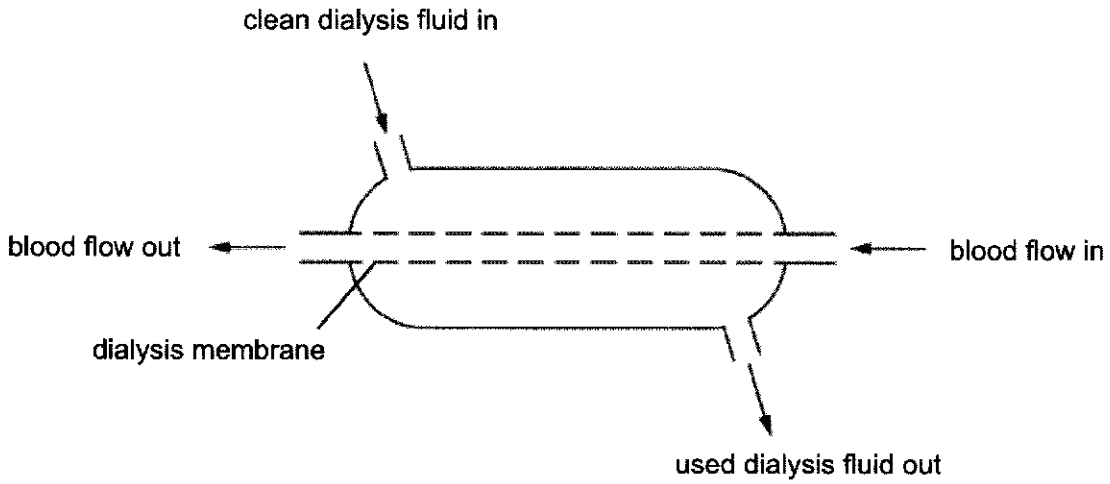
21 Drinks that contain caffeine inhibits the production of anti-diuretic hormone (ADH).

Which shows the results of these drinks on the kidney tubule and the urine produced?

	amount of water reabsorbed by kidney tubule	effect on urine produced	
		quantity	concentration
A	decreased	decreased	concentrated
B	decreased	increased	diluted
C	increased	decreased	concentrated
D	increased	increased	diluted

[Turn over

22 The diagram shows a simplified dialysis machine.



What substance would **not** be present in the clean dialysis fluid flowing in?

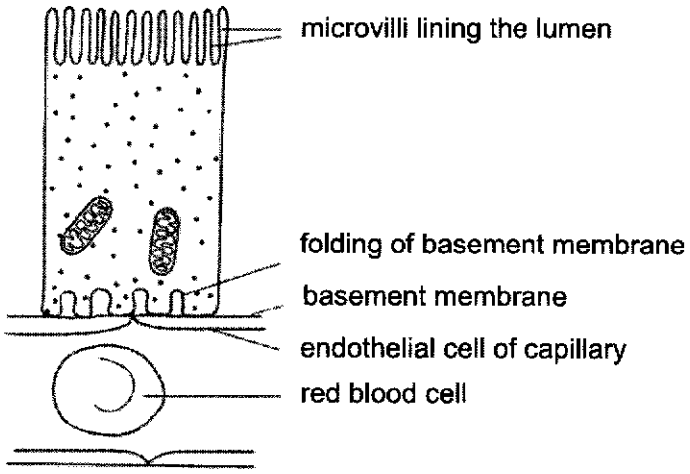
A glucose

B salt

C urea

D water

23 The diagram shows a part of a kidney nephron.



Which part of the kidney was this taken from?

A afferent arteriole

B Bowman's capsule

C glomerulus

D proximal convoluted tubule

24 Which of the following processes in the body is **not** controlled by negative feedback?

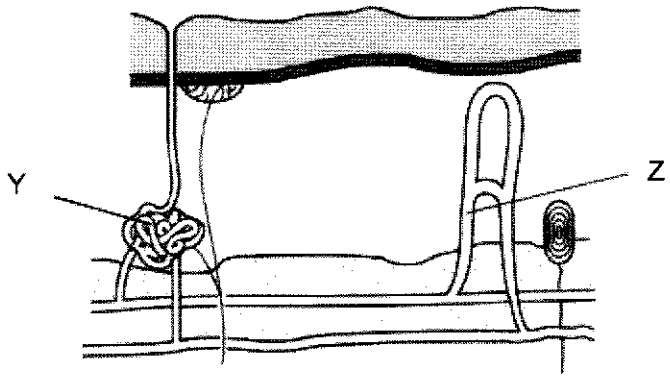
A regulation of body temperature

B regulation of blood glucose level

C regulation of uterine contraction during birth

D regulation of water potential of blood plasma

25 The diagram shows some structures in human skin.



Which labels describe the structures in cold conditions?

	Y	Z
A	active	constricted
B	active	dilated
C	inactive	constricted
D	inactive	dilated

26 Ali injured his hand in a car accident. Shortly after that, he could feel the objects he touched with his hand, but was unable to move his hand away from them.

What could have caused this?

A The receptors in his hand were damaged.

B Relay neurones in his hand could no longer carry out their function.

C Only the nerve connection between receptors and the central nervous system was cut.

D Only the nerve connection between the central nervous system and the effectors was cut.

[Turn over

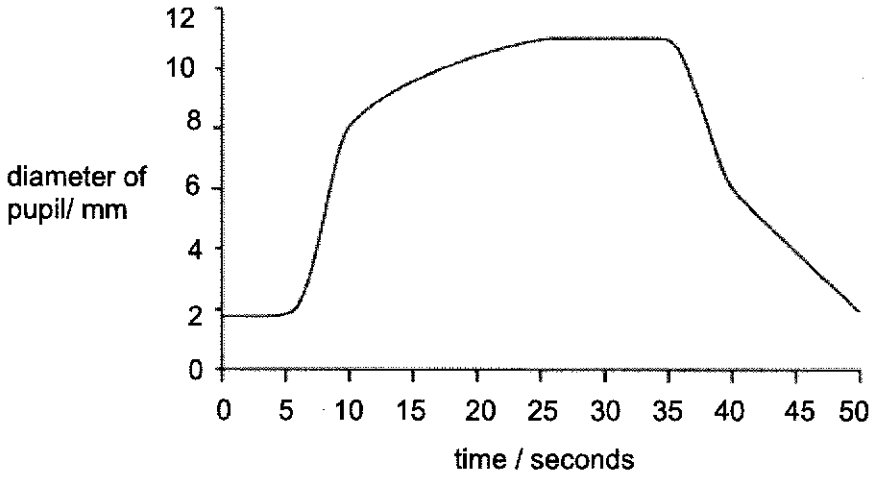
27 Insulin is injected into a diabetic patient rather than taken orally. This is because insulin

1 can be broken down by the digestive enzymes.
2 will be destroyed by the body immune system.
3 cannot be absorbed in the small intestine.
4 can travel faster through the blood stream than through the lymphatic network.

Which statement(s) are correct?

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

28 The graph shows the changes in the diameter of the pupil of the eye as the light intensity of the surroundings is changed.



Which option describes what is happening between 5 and 10 seconds?

	light intensity	radial muscles in iris	circular muscles in iris
A	decrease	contract	relax
B	decrease	relax	contract
C	increase	contract	relax
D	increase	relax	contract

29 Which of the following statements about a reflex action is correct?

A An impulse is produced in the brain before being transmitted to the neurones.
B It is an immediate response to a specific stimulus without conscious control.
C It is triggered by a certain stimulus that an organism learns to associate with danger.
D It requires conscious effort and involve processing of information and conscious decision.

30 A potato plant reproduces asexually by tubers, which are found underground. Four observations were made about the potato plant.

1 Only one parent plant is needed

2 The tubers are attached to the parent plant underground

3 The tubers have identical genotype as the parent plant.

4 The potato plant produces flowers that can self-pollinate

Which of the above observations describe asexual reproduction?

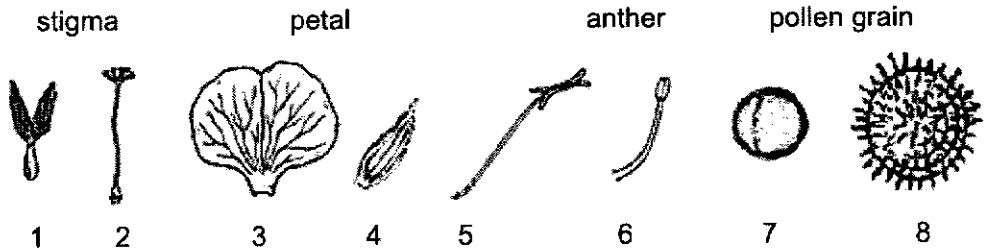
A 1 and 3

B 1 and 4

C 2 and 4

D 3 and 4

31 The diagram shows a collection of parts from different flowers.



Which parts are likely to be found in a wind-pollinated flower?

A 1, 3, 5, 7

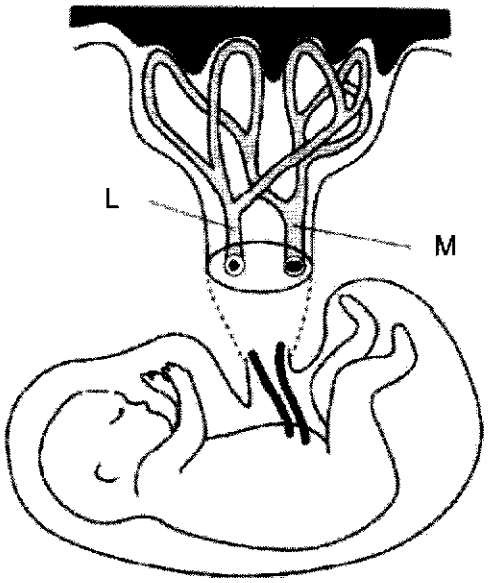
B 1, 4, 5, 7

C 2, 3, 6, 8

D 2, 4, 5, 7

[Turn over

32 The diagram shows the placenta and its associated blood vessels.

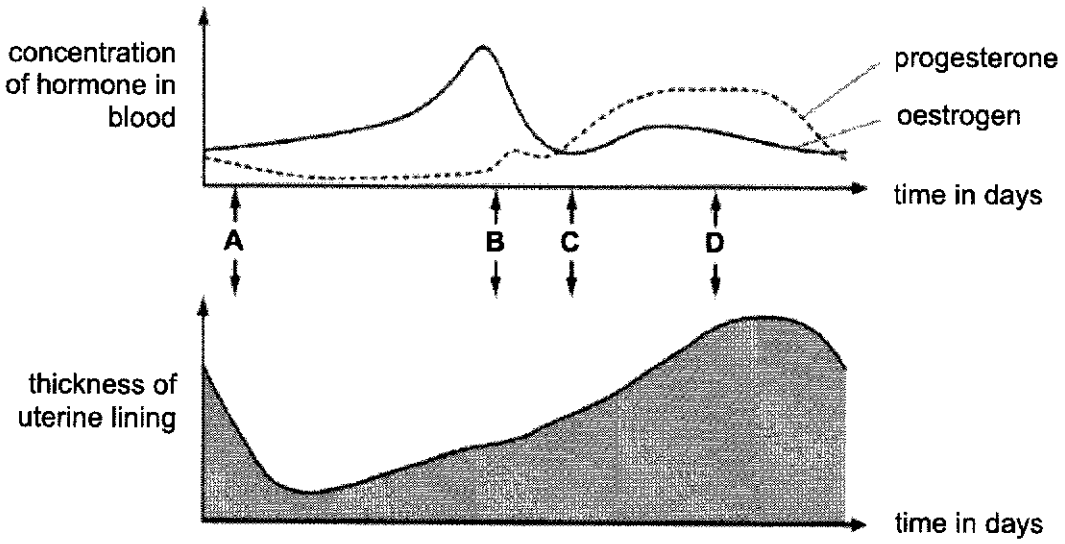


Which option shows the correct levels of dissolved substances in vessel L compared to vessel M?

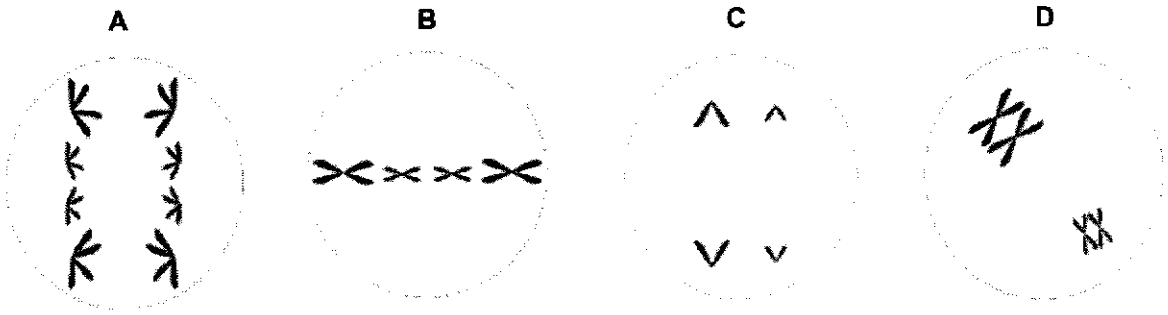
	urea	amino acids	oxygen
A	higher	higher	higher
B	higher	lower	lower
C	lower	higher	higher
D	lower	lower	lower

33 The diagram shows the thickness of the uterine lining and the concentrations of oestrogen and progesterone, throughout one menstrual cycle.

On which day does ovulation occur?



34 Which diagram represents a cell that has a diploid number of four and is undergoing mitosis?



35 Which statement about chromosomes and genes is correct?

A Chromosomes are long DNA molecules called genes which are divided into sections.

B Chromosomes are made up of DNA molecules which are made up of different genes.

C Chromosomes include a single molecule of DNA divided into sections called genes.

D Chromosomes include genes which are divided into sections called DNA molecules.

36 Induced chromosome mutations produced a fertile hybrid species from cabbage and radish. The table shows the chromosome numbers in the parental species and the hybrids.

type of cell	number of chromosomes per cell
parental cabbage	18
parental radish	18
parental gametes	9
F_1 hybrids	18
F_1 gametes	18
F_2 hybrids	36
F_2 gametes	18
F_3 hybrids	36

At which stage did chromosomal mutation occur?

A during formation of F_1 gametes

B during formation of F_2 gametes

C during fusion of F_1 gametes

D during fusion of parental gametes

[Turn over

37 Which of the following will result in the formation of a transgenic organism?

A adding a chemical to embryo plants causing the number of chromosomes to double, which makes the plant produce larger fruits

B allowing the cross-pollination of two different varieties of the same species of plant to obtain high yield crops resistant to insect pests

C fusing an egg cell without a nucleus from one animal with a somatic cell from a related species

D inserting a gene from one species into the egg cell of a different species to make the animal produced grow faster

38 What is a potential danger of growing genetically engineered crops?

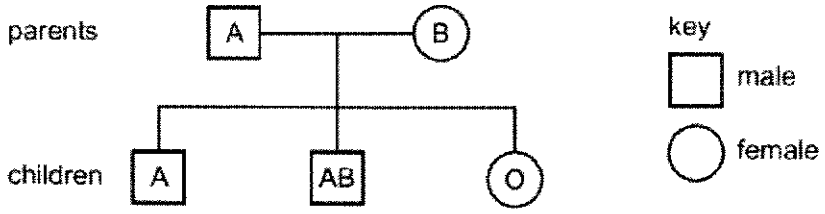
A changing the genes of plants in nearby ecosystems

B producing crops with different nutrient content

C producing greater yields within a shorter time

D reducing the amount of pesticides on crops

39 The diagram shows the phenotypes for blood groups in a family.



Which statement about the genotypes of the parents is correct?

A Both parents have alleles for blood group A and B.

B Both parents have the allele for blood group O.

C Only the father has the allele for blood group O.

D Only the mother has the allele for blood group O.

40 Which statement describes an example of artificial selection?

A Bulls are mated with cows that produce the most milk.

B Caterpillar population can be controlled by releasing small wasps that kill caterpillars.

C Mosquitoes have developed strains that are resistant to insecticides.

D Some strains of bacteria are used to produce antibiotics.

End of paper

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JURONGVILLE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2020
Secondary 4 Express

STUDENT NAME

CLASS

INDEX NUMBER

BIOLOGY

6093/02

Paper 2

2 Sep 2020

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

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

For Examiner's Use	
Section A	50
Section B	
Q8	10
Q9	10
Q10	10
Total	80

Setter: Ms Alvina Wong

This document consists of **16** printed pages.

Section A: Structured Questions [50 marks]
Answer **all** questions. Write your answers in the spaces provided.

1 Fig. 1.1 shows the human gas exchange system.

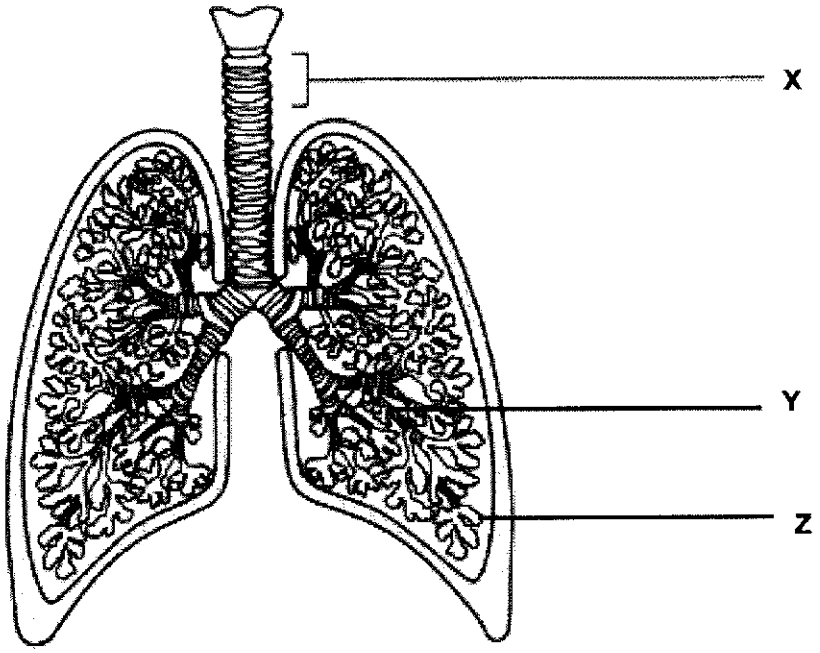

Fig. 1.1

(a) Name the structures labelled **X, Y** and **Z** in Fig. 1.1.

X .....

Y .....

Z ..... [3]

(b) Chronic obstructive lung disease occurs due to frequent exposure to tobacco smoke.

Describe the process of gas exchange in healthy lungs and suggest how it compares with gas exchange in sufferers of chronic obstructive lung disease.

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..... [4]

[Total: 7]

2 (a) Cactus plants live in hotter and drier parts of the world than buttercup plants. Both cactus plants and buttercup plants have stomata.

Fig. 2.1 shows how the size of the stomatal openings in these two plants varies during a 24-hour period.

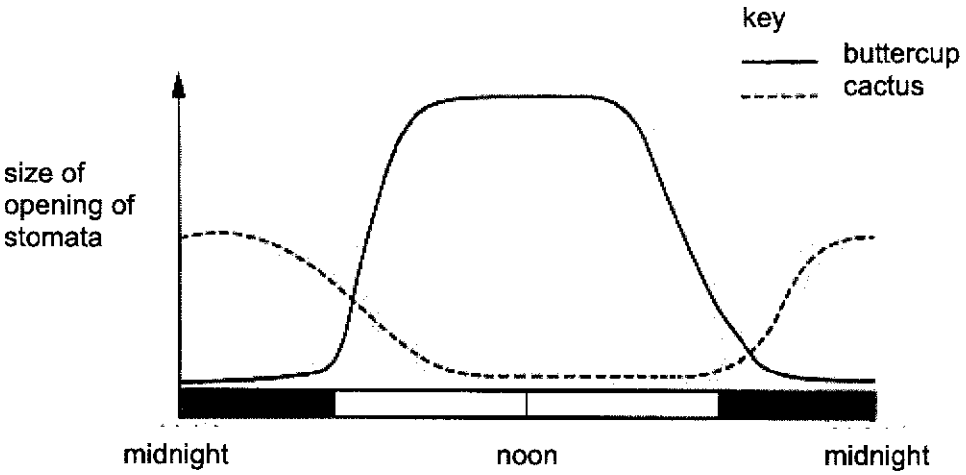

Fig. 2.1

(i) With reference to Fig 2.1 and the information given, describe and explain differences in water loss by transpiration during the day between these two plants.

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.....

..... [2]

(ii) Suggest another adaptation that cactus plants may possess to further reduce transpiration rate.

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..... [1]

[Turn Over

(b) The common oleander, *Nerium oleander*, shown in Fig. 2.2, is a plant grown for the attractive flowers that it produces.

However, this plant is poisonous, as its leaves produce toxic organic compounds.

Fig. 2.2

(i) Aphids are small insects that feed on the sap of plants. When aphids feed on the sap present in vascular tissue of leaves and stems, a sugary liquid called honeydew is passed out of the gut of the aphids. The honeydew can be analysed to find out what is present in the sap.

State the name of the vascular tissue from which the aphids feed.

..... [1]

(ii) An investigation found that aphids feeding on *N. oleander* produced honeydew containing toxic organic compounds. Suggest why the compounds were present in the sap from the vascular tissue.

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..... [2]

[Total: 6]

3 The entire genome of the fruit fly, *Drosophila melanogaster*, was fully sequenced in 2000.

There are 4 pairs of homologous chromosomes in the fruit fly.

(a) Explain the term *homologous chromosome*.

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..... [1]

(b) Assuming crossing over has already taken place, complete the diagrams below to show how all the daughter cells and chromosomes look like

(i) during metaphase I,

[2]

(ii) at the end of cytokinesis II

[2]

(c) During the lifespan of the fruit fly, its body tissues will get damaged.

Explain the importance of mitosis in the repair of damaged tissue.

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..... [2]

[Total: 7]

[Turn Over

4 The flow of blood through the skin can be investigated by using an instrument known as the blood flow meter.

The blood flow through the skin of some volunteers was measured with the blood flow meter. when their skin was exposed to different temperatures.

The volunteers were also exposed to capsaicin, a compound found in chili, which causes the sensation of feeling hot at its point of contact, in this case the skin. The blood flow through their skin was measured again at different temperatures.

Fig. 4.1 shows the results.

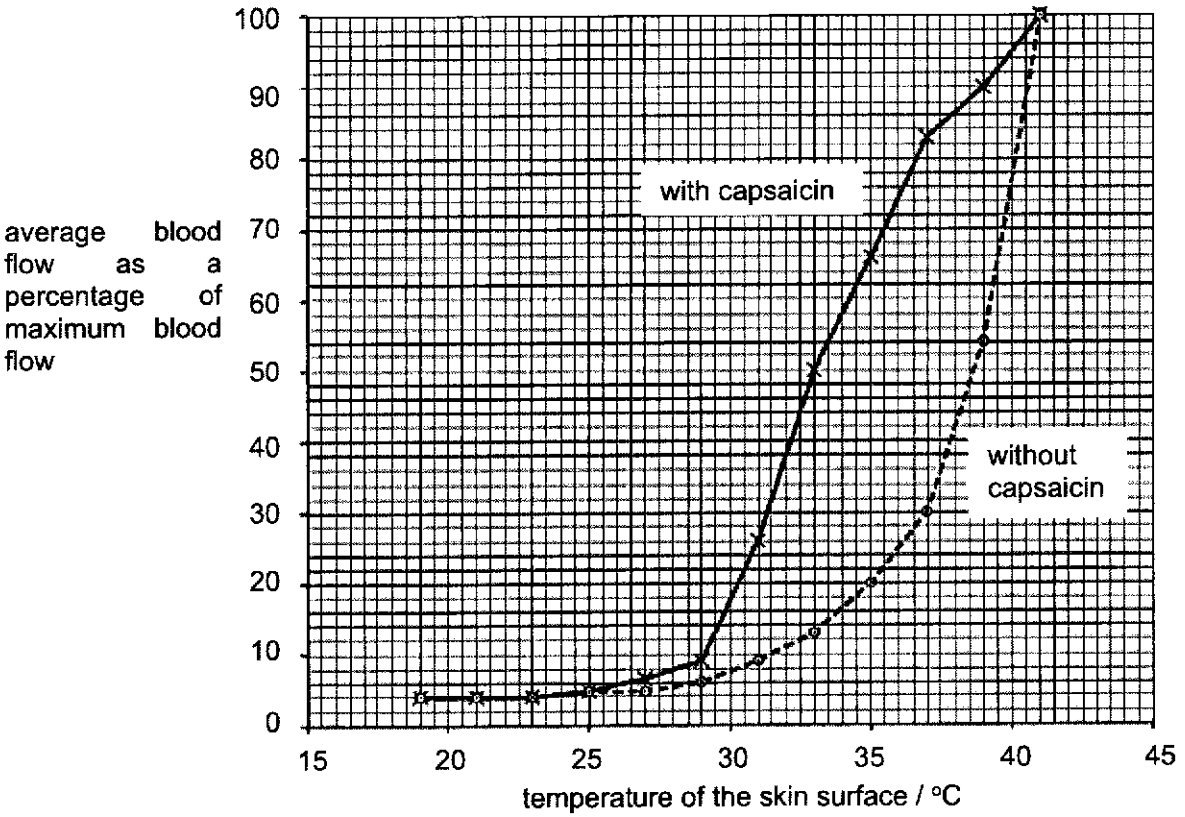

Fig. 4.1

(a) With reference to Fig. 4.1, describe the effect of increasing the temperature of the skin surface on blood flow to the skin without capsaicin.

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..... [2]

(b) Explain the mechanism that increases blood flow through the skin.

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..... [3]

(c) State the difference between the average blood flow for the treatments (with and wihout capsaicin) at 35 °C. Show your working.

..... [1]

(d) A volunteer accidentally consumed some capsaicin and spat it out when she felt the hot sensation against her tongue. Describe how she was able to make this decision.

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..... [4]

[Total: 10]

[Turn Over

5 (a) Fig. 5.1 shows the vertical section through the mammalian heart. The labels **Q** to **X** represent the valves and blood vessels of the heart.

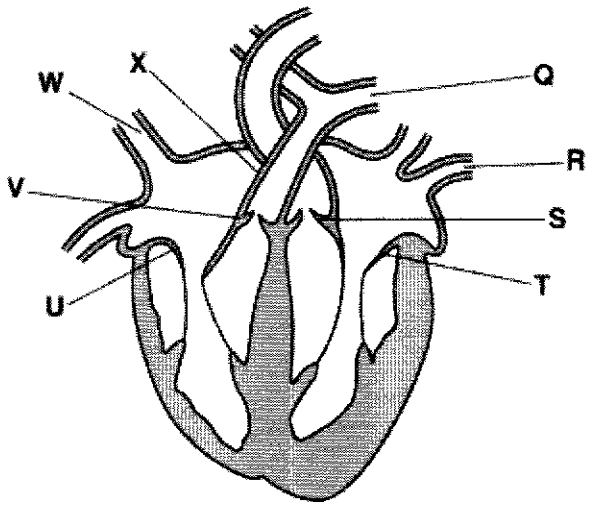

Fig. 5.1

(i) Label on the graph, the left ventricle using the letter "**L**" and the right atrium using the letter "**A**". [2]

(ii) Identify the label that represents the valve that prevents the backflow of blood for the aorta into the ventricle.

..... [1]

(iii) Name the blood vessel that carries oxygenated blood from the lungs to the heart and state which label represents this blood vessel.

name .....

label ..... [1]

(b) Fig. 5.2 is a graph showing how the blood pressure in the pulmonary artery and right ventricle changes during one cardiac cycle.

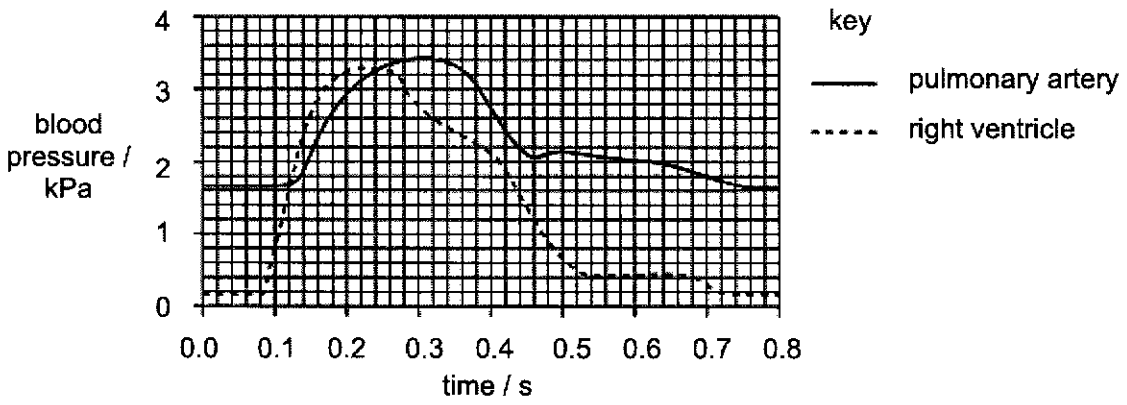

Fig. 5.2

State the time at which:

(i) the valve between the right ventricle and pulmonary artery closes.

..... [1]

(ii) the ventricle begins to contract.

..... [1]

(iii) State and explain the similarities and differences between Fig. 5.2 and a graph showing how the blood pressure for the left ventricle changes during the same cardiac cycle.

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..... [4]

[Total: 10]

[Turn Over

6 Fig. 6.1 shows parts of a plant growing above ground.

Fig. 6.1

(a) **(i)** With reference to Fig. 6.1, state the type of reproduction that takes place using the flower in this plant.

..... [1]

(ii) The plant is also able to reproduce without using the flower, to produce new plants from the plantlets. State the type of reproduction that involves the plantlets.

..... [1]

(b) Suggest and explain the advantages to the plant by reproducing by using the flowers and plantlets.

.....

.....

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.....

.....

..... [4]

[Total: 6]

7 Jason has perfect eyesight and he is currently healthy. Fig. 7.1 shows a view of his vision as he sees a book held 5 cm in front of his eyes. The image is not focused in his eyes.

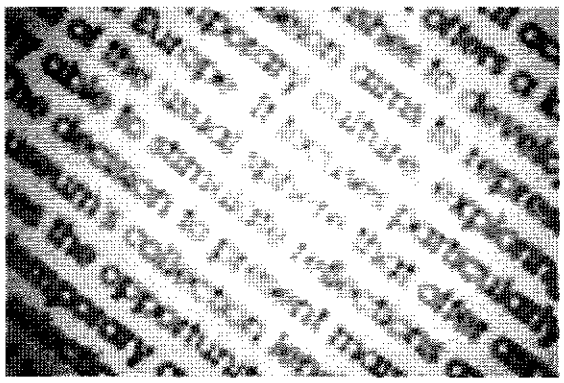


Fig. 7.1

Describe the changes to his eyes to result in the production of a focused image.

.....

.....

.....

.....

.....

.....

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

[Total: 4]

[Turn Over

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

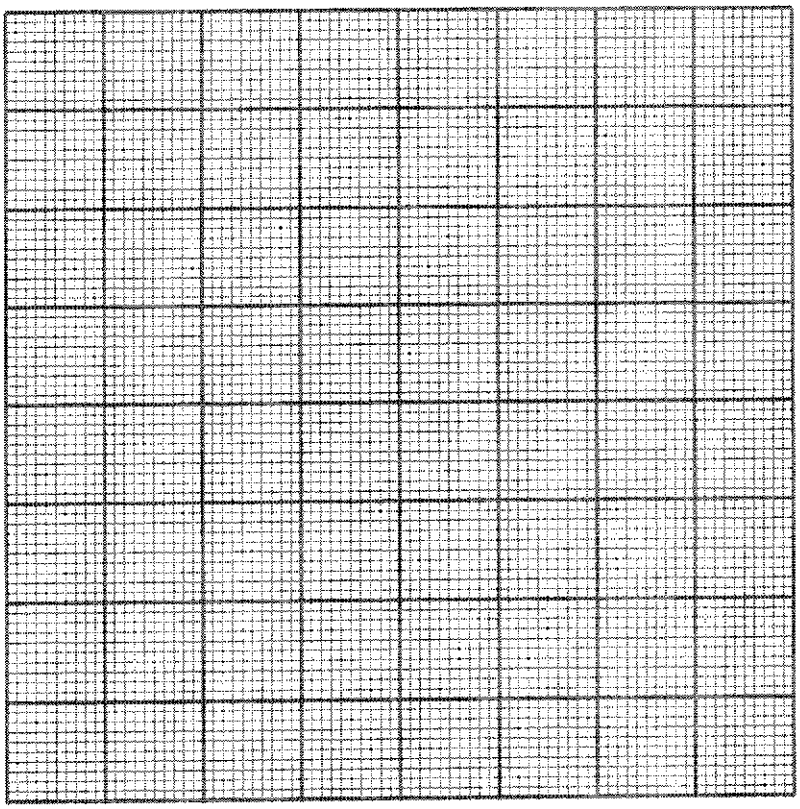
8 Arabidopsis *thaliana* (A. *thaliana*) is a small flowering plant native throughout Eurasia. For the past century, studies of this weed have provided valuable insights into the development of leaf genetics.

In a study, a scientist measured the leaf sizes from a sample of 30 A. *thaliana* plants. The data was recorded in Table 8.1 below

Table 8.1

Length of A. *thaliana*	Frequency
0.50 – 0.59	5
0.60 – 0.69	14
0.70 – 0.79	23
0.80 – 0.89	34
0.90 – 0.99	17
1.00 – 1.09	8
1.10 – 1.19	1

(a) Plot a histogram to show the variation of leaf sizes using the data in Table 8.1.



[4]

(b) Based on the data, state and explain the type of variation shown.

.....

.....

..... [2]

The scientist eventually discovered that the alleles controlling leaf size is codominant.

Plants that are homozygous dominant tend to produce leaves that are larger while homozygous recessive plants produce leaves that are smaller. Heterozygous plants produce leaves that fall in the middle range.

(c) Define the term *codominance*.

.....

..... [1]

(d) Draw a genetic diagram to show the possible offspring when a homozygous dominant A. *thaliana* was crossed with a heterozygous A. *thaliana*.

Let 'D' represent the dominant allele and 'd' represent the recessive allele.

[3]

[Total: 10]

[Turn Over

9 (a) Restriction enzymes cut DNA into fragments by cutting at specific sites determined by the sequence of bases.

Fig. 9.1 shows the base sequence cut by three different restriction enzymes and a section of DNA cut by one of these enzymes. The arrow represents the cut site.

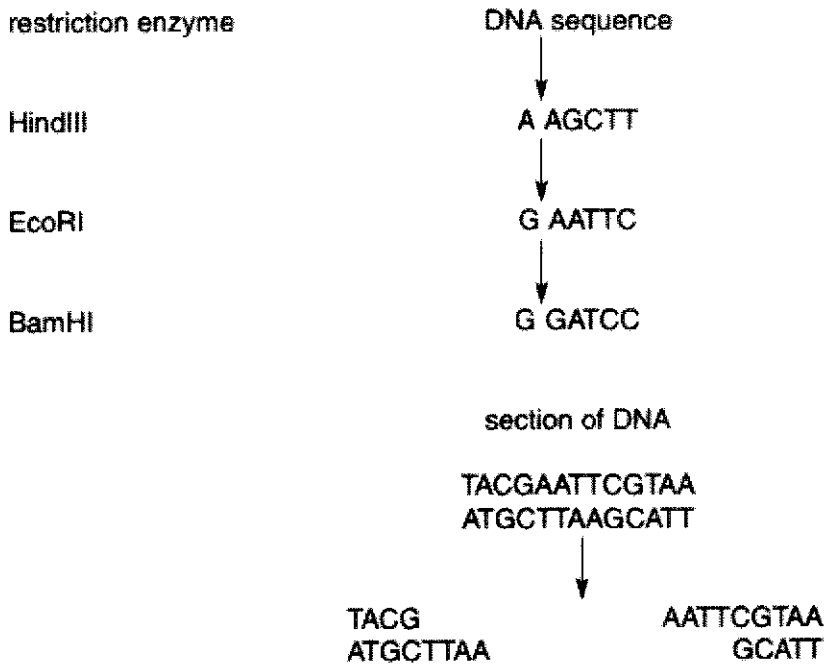


Fig. 9.1

(i) Identify the restriction enzyme that cut the section of the DNA shown in Fig. 9.1.

..... [1]

(ii) Human genes may be cloned by inserting lengths of DNA into bacteria. This may be carried out by inserting the DNA into a plasmid.

Using a named example, describe how lengths of DNA, cut by restriction enzymes, are inserted into plasmids.

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..... [6]

(b) Describe an experiment to test for the presence of restriction enzyme in an unknown sample. Include any observations that may be made.

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.....

.....

..... [3]

[Total: 10]

[Turn Over

10 **(a)** Describe and explain how each of the following affects enzyme activity:

pH .....

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.....

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.....

.....

.....

.....

.....

temperature .....

.....

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.....

..... [7]

(b) Name one enzyme that acts in a named part of the alimentary canal and describe the role of the enzyme in digestion.

.....

.....

.....

.....

..... [3]

[Total: 10]

END OF PAPER

Jurongville Secondary School
Science Department 2020
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	C		[1]	
4	C		[1]	
5	B		[1]	
6	C		[1]	
7	C		[1]	
8	D		[1]	
9	D		[1]	
10	A		[1]	
11	B		[1]	
12	B		[1]	
13	A		[1]	
14	A		[1]	
15	D		[1]	
16	A		[1]	
17	C		[1]	
18	B		[1]	
19	D		[1]	
20	A		[1]	
21	B		[1]	
22	C		[1]	
23	D		[1]	
24	C		[1]	
25	C		[1]	
26	D		[1]	

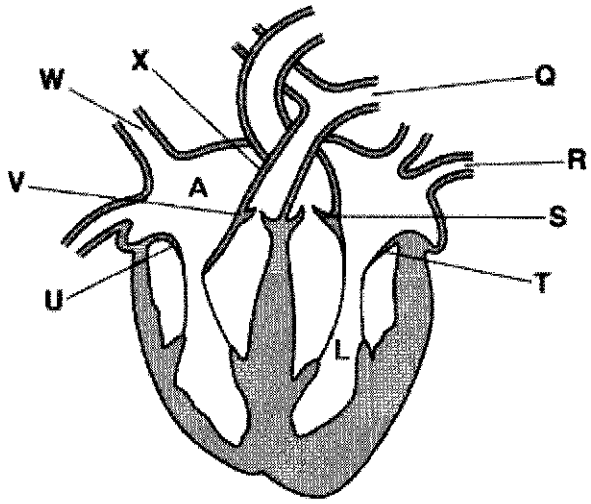
Qn	Marking Scheme	Remarks	Marks	Marker's Report
27	**A**		[1]	
28	**A**		[1]	
29	**B**		[1]	
30	**A**		[1]	
31	**B**		[1]	
32	**B**		[1]	
33	**B**		[1]	
34	**B**		[1]	
35	**B**		[1]	
36	**A**		[1]	
37	**D**		[1]	
38	**A**		[1]	
39	**B**		[1]	
40	**A**		[1]	

ANSWERS

Qn	Marking Scheme	Remarks	Marks
Section A			
1a	X: Trachea Y: Bronchiole Z: alveolus (A: alveoli)	R: spelling error. CAO	**1** **1** **1**
1b	<u>in healthy lungs</u> **1.** <u>correct</u> direction of movement of <u>both</u> respiratory gases ; e.g. oxygen from alveolus towards blood and carbon dioxide from blood to alveolus ; oxygen enters the blood system and carbon dioxide leaves A red blood cell / haemoglobin, as ref. to blood **2.** diffusion (of, oxygen / carbon dioxide) or movement, down a concentration gradient / from high(er) to low(er) concentration ; A: implied e.g. oxygen enters blood from a higher concentration R: diffusion of gases (with no mention of concentration gradient) **3.** across the alveoli wall into the capillaries; <u>Comparison to COPD</u> **4.** higher rate of exchange / increased rate of diffusion / steeper concentration gradient ; A more oxygen to blood per unit time / more carbon dioxide to alveolus per unit time R: more efficient gas exchange, better gas exchange / faster diffusion Accept any valid point: e.g. larger surface area (for, gas exchange / diffusion) shorter diffusion distance ref. to (greater) ability to, stretch / recoil (for ventilation to maintain gradient) or ref. to elasticity (more v fewer elastic fibres is not sufficient)		**1** **1** **1** **1**
2ai	1. The <u>size</u> of the largest stomata opening is <u>smaller</u> in cacti as compared to buttercup plants.		**1**

Qn	Marking Scheme	Remarks	Marks
	A ref. to difference in size of stomata opening 2. Water loss is higher in cacti due to higher surrounding temperatures and the smaller stomata size reduces the amount of water loss via transpiration helping the cacti to conserve water. A ref. to environment the plants are in A vice versa answer (ref. to buttercup plants)		1
2aii	Thick and waxy cuticle / reduced leaves / fewer number of stomata R cactus have no leaves		1
2bi	Phloem R spelling error	CAO	1
2bii	Compound is being transported in the phloem from the leaves; Towards the storage organs/to other parts of the plant for storage/assimilation/area where they are required; Used as a defence mechanism to prevent aphids from feeding on the plant;		1 1 1
3a	Homologous chromosomes are chromosomes from each parent that contain the same genes at the same locus of the same size.		1
3bi	2 cells; 4 replicated chromosomes (A showing genetic recombination/not showing)		1 1
3bii	4 cells; 4 single chromosomes (chromosomes should match what was drawn in 3bi)		1 1
3c	1. (division that) produces new / daughter cells A produces more cells or (so) replaces, damaged / lost / dead, cells ;		1

Qn	Marking Scheme	Remarks	Marks
	2. new / daughter cells produced that are genetically identical ; A genetic information not lost R same number of chromosomes		1
4a	1. blood flow remains constant at 4-5% when skin temperature is at 19°C to 27°C [1] 2. then blood flow increases to maximum of 100% when temperature of skin increases from 27°C to 41°C. [1] values must be quoted for full 2 marks to be awarded. If not, max 1		1 1
4b	1. Increase in skin temperature detected by thermoreceptor (in skin) 2. Hypothalamus is triggered / activated 3. which sent impulses to muscles in arterioles and shunt vessels, causes vasodilation of arterioles while the shunt vessels constrict, increasing blood flow into capillaries near surface of skin		1 1 1
4c	66-20=46%		1
4d	1. An impulse is produced in the forebrain; 2. transmitted by a relay neurone in the spinal cord; A transmitted by a relay neurone down the white matter and then grey matter in the brain 3. which is then transmitted to a motor neurone; 4. which transmits it the impulse to the effector muscles in the mouth;		1 1 1 1

Qn	Marking Scheme	Remarks	Marks
5ai			1ea Max 2
5aii	S		1
5aiii	Name: pulmonary vein Label: R	CAO Both must be correct	1
5bi	0.24s / 0.25s		1
5bii	0.08 s / 0.09 s ; A 0.08 s – 0.20s		1
5biii	<u>similarity</u> 1. make reference to increases and decreases in pressure at same time **A** description for part of the graph 2. left and right ventricle contract and relax at the same time ref. that events in cardiac cycle occur are coordinated ;	Min 1 point per section	 1 1

Qn	Marking Scheme	Remarks	Marks
	Differences Left ventricle reaches higher blood pressure, (than RV) ; Explanation left ventricle pumps blood to whole body while the right ventricle pumps blood only to the lungs walls of left ventricle are thicker / more muscular/ exert more force		1 1 Max 4
6ai	Sexual	CAO	1
6aii	Asexual	CAO	1
6b	Flowers 1. population more likely to survive environmental change / disease due to increased genetic variation 2. reduction of competition as offsprings are more widely dispersed; plantlets 1. fast method as only one parent plant is needed; 2. new plants in an environment to which plant is well suited as beneficial traits are inherited;	Min 1 point per method Explanation and suggestion must be given	1ed
7	Ciliary muscles contract, relaxing the pull on the suspensory ligament; Suspensory ligament slacken, relaxing their pull on the lens; Lens, being elastic, becomes thicker and more convex, decreasing the focal length; Light rays from the book are focused on the retina, stimulating photoreceptors;		1 1 1 1
Section B			
8a	Correct height of bars; Bars are connected to each other;		1 1

Qn	Marking Scheme	Remarks	Marks
	Axis with labels; Appropriate scale;		1 1
8b	Continuous; Length of *A. thaliana* does not fall into discrete categories/shows a range of values;		1 1
8c	both alleles are equally expressed in the heterozygous condition		1
8d	Parental phenotype Large Medium Parental genotype DD x Dd Gametes ◯ D (D) (D) (d) F1 genotype DD Dd DD Dd F1 phenotype Large medium Large medium F1 ratio 2 large : 2 medium 1 large : 1 medium		**Any 2 lines – 1m** **Max 3m**
9ai	EcoRI		1
9aii	1. Insulin is produced; 2. Cut plasmid and insulin gene with the <u>same</u> RE 3. Plasmid and gene mixed together, ref complementary base pairing 4. DNA ligase seals plasmid and gene together 5. form recombinant plasmid 6. Apply heat/electric shock		1 1 1 1 1 1

Qn	Marking Scheme	Remarks	Marks
9b	1. Add $2cm^3$ of biuret solution/NaOH + $CuSO_4$ 2. Positive test: violet solution formed 3. Negative test: blue solution		**1** **1** **1**
10a	(pH or temperature) Ds: best / optimum / fastest ; Ex: rate of enzyme-substrate complex formation is the highest Ex: active site complementary to substrate Ds: rate slower both sides of the optimum ; Ex: denaturation + pH not optimum / high temperature Ex: active site ; Ex: change in shape ; Ex: substrate no longer fits ; (temperature only) Ds: Increase in temperature increases rate of reaction ; Ex: heat increases rate of molecular movement / kinetic energy ; Ex: more collisions (at higher temperature) ;	Description of enzyme activity is affected must be given for full 7m to be awarded.	**1ea** **Max 7**
10b	1. named enzyme from alimentary canal ; 2. correct named location for action of enzyme named ; 3. correct named substrate + product(s) for substrate named ;		**1** **1** **1**