BEDOK SOUTH SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2020

4EXP

CANDIDATE NAME

CLASS

INDEX NUMBER

BIOLOGY

6093/01

Paper 1 Multiple Choice

3 September 2020

1 hour

Candidates answer on the Multiple Choice Answer Sheet.
Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

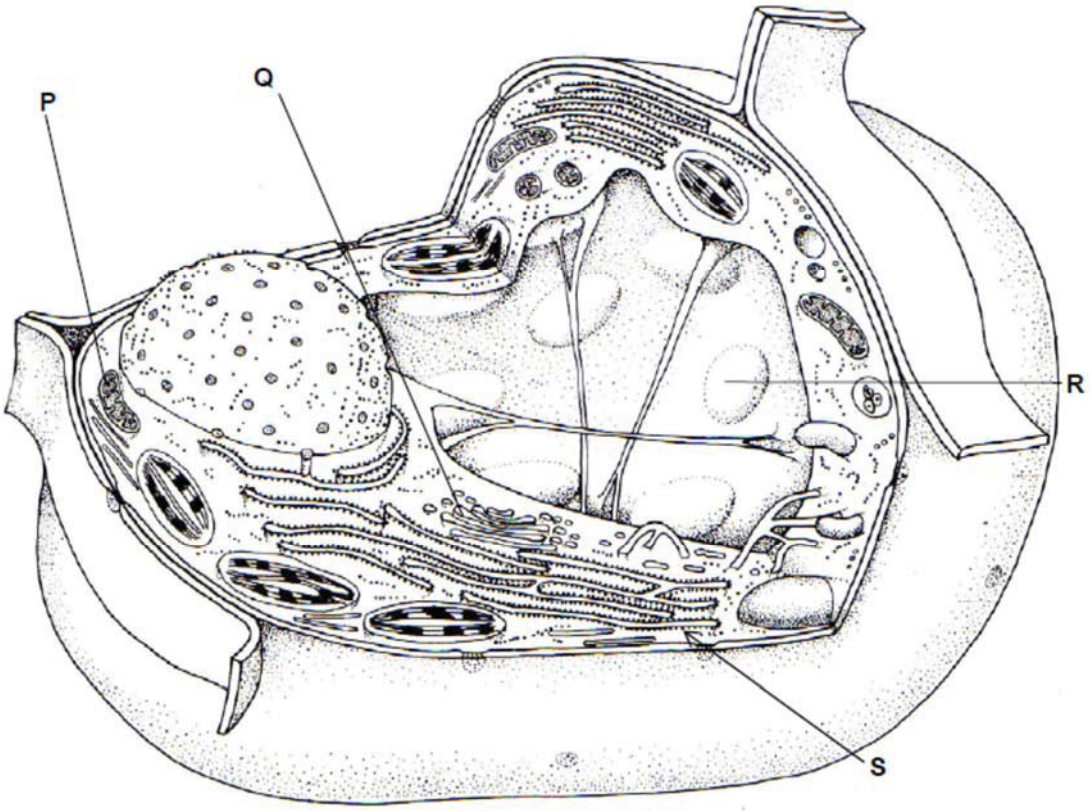
Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class and index number on the Question Paper and Answer Sheet.

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

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.

Setter: Ms. Nancy Sim

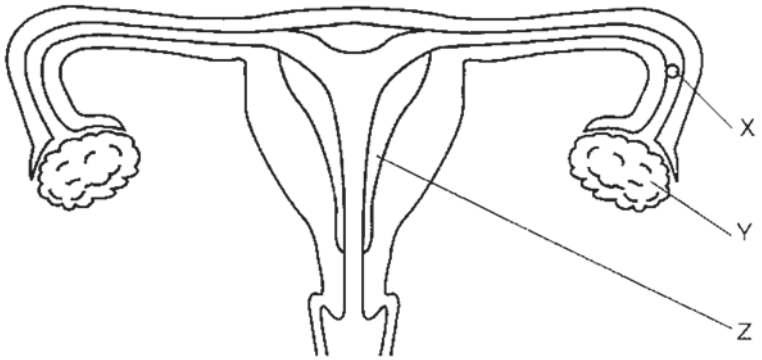
1 The diagram below shows a cell that has its organelles and membrane systems labelled.



Which gives the correct identifications?

	P	Q	R	S
A	mitochondrion	Golgi body	vacuole	ribosome
B	chloroplast	Golgi body	mitochondrion	vacuole
C	ribosome	mitochondrion	Golgi body	vacuole
D	chloroplast	ribosome	Golgi body	mitochondrion

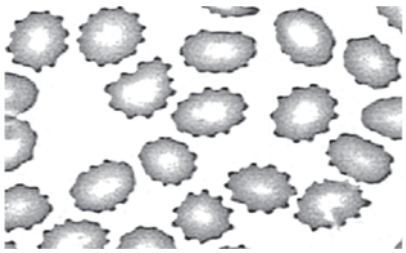
2 The diagram below shows the human female reproductive system.



What is the level of organisation of structures X, Y and Z?

	cell	tissue	organ
A	X	Y	Z
B	X	Z	Y
C	Y	X	Z
D	Z	Y	X

3 The diagram below shows red blood cells an hour after they were immersed in a salt solution and observed under a microscope.



Which is likely to be the initial salt concentration of the cells and solution?

	salt concentration of cells / mol dm^{-3}	salt concentration of solution / mol dm^{-3}
A	1.0	0.5
B	1.0	1.5
C	1.5	1.5
D	1.5	0.5

4 Which property of water makes it suitable for its role in many metabolic reactions?

A It has a high specific heat capacity.

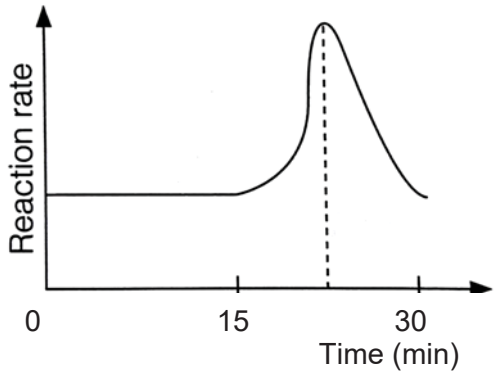
B It is an excellent solvent.

C It is incompressible.

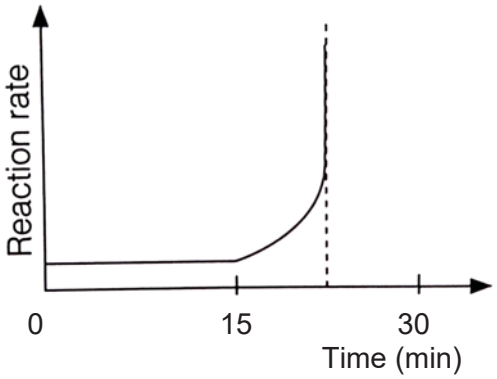
D It is most dense at + 4 °C.

5 Which graph shows the rate of the enzymatic reaction when a hot mixture of starch and salivary amylase is cooled down from 100 °C to 0 °C over 30 minutes?

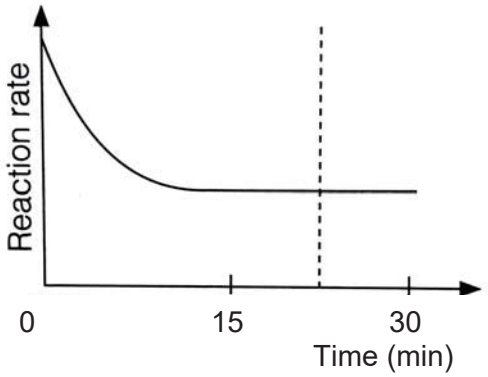
A



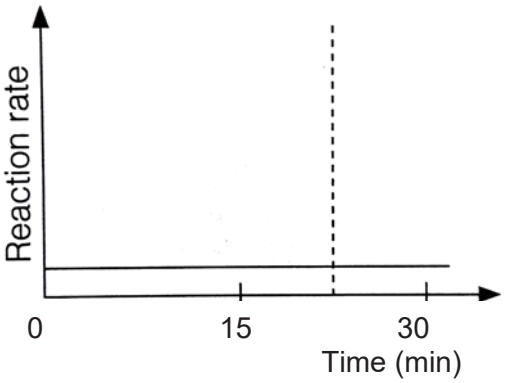
B



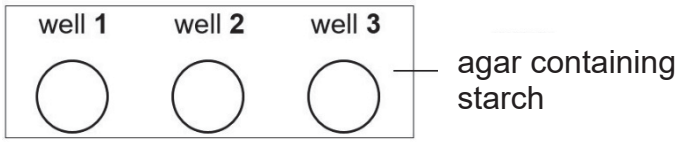
C



D



6 Digestive juices were collected from three regions of the human alimentary canal. Drops of these juices were added to wells made in an agar of starch as shown below.



After an hour, the wells were rinsed with distilled water and flooded with iodine solution. The results are summarized in the following table.

	well **1**	well **2**	well **3**
colour of iodine solution	blue-black	brown	brown

Which correctly identifies the regions of the alimentary canal from which the three digestive juices were obtained?

	well **1**	well **2**	well **3**
A	oral cavity	small intestine	stomach
B	oral cavity	stomach	small intestine
C	small intestine	oral cavity	stomach
D	stomach	small intestine	oral cavity

7 Liver cirrhosis is a disease that causes the hardening and scarring of the liver tissues. The following statements show some effects of cirrhosis:

I Bile production will be reduced significantly.
II Digestive enzyme production will be reduced.
III Glycogen cannot be stored.
IV Urea will not be formed.
V Worn-out red blood cells cannot be broken down.

Which statements are correct?

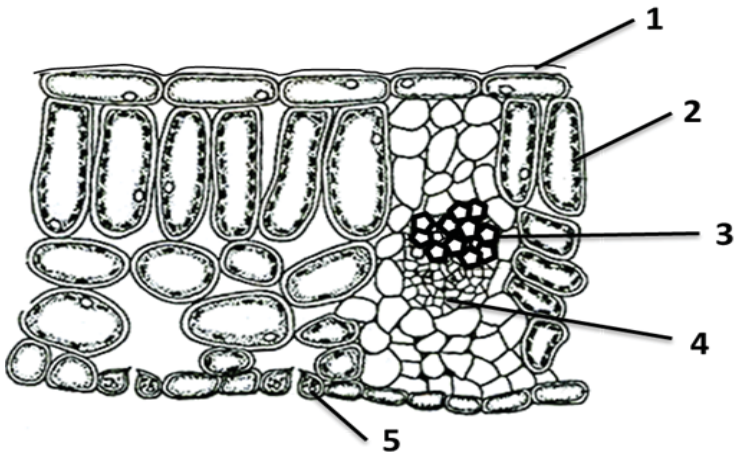
A I, II and IV

B I, III and IV

C II, III and V

D III, IV and V

8 The diagram below shows the transverse section of a leaf.



The plant was placed in a glass jar containing radioactive carbon dioxide and then exposed to sunlight.

In which order would radioactivity be detected in the leaf?

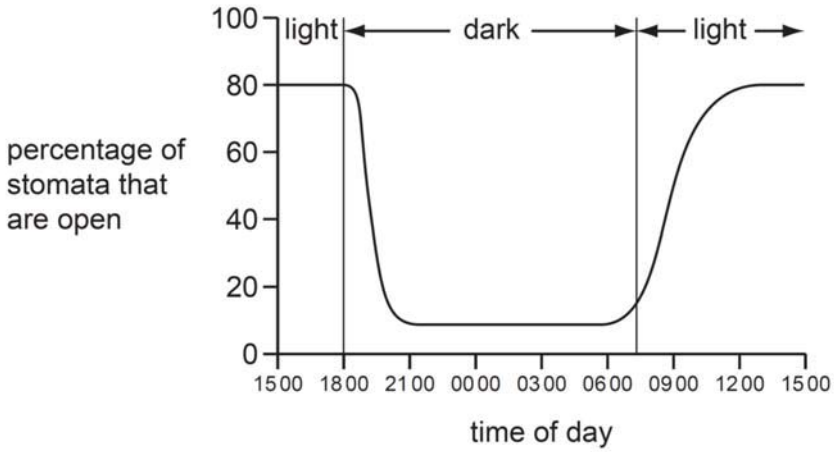
A 1, 5, 2

B 1, 5, 4

C 5, 2, 4

D 5, 4, 3

9 The graph shows stomatal opening and closing in the leaves of a species of *Pelargonium*, during a 24 hour period.



Which is a suitable conclusion?

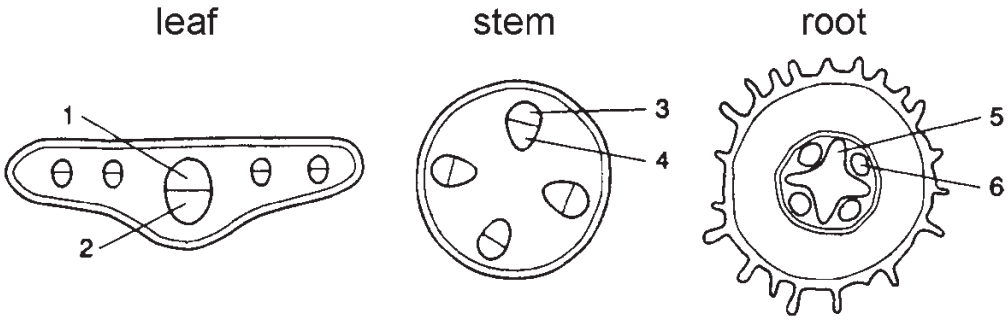
A Gas exchange occurs when stomata are open.

B Stomata open as light intensity increases.

C Stomata open as temperature increases.

D Transpiration does not occur in the dark.

10 To investigate the path taken by a particular mineral in a plant species, the roots of the plant was immersed in a solution with dissolved mineral X. The diagrams show cross-sections of the leaf, stem and root after 48 hours.

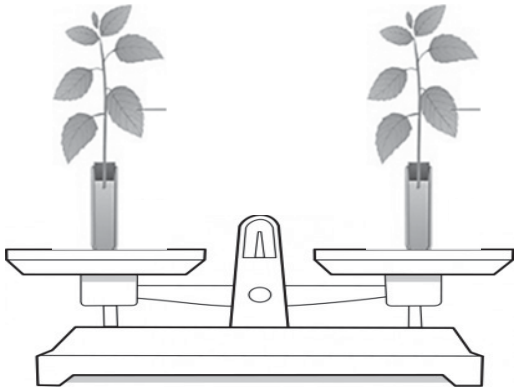


Which numbered parts would be most likely to show evidence of mineral X?

	Leaf	Stem	Root
A	1	4	5
B	1	3	6
C	2	4	6
D	2	3	5

11 The diagram below shows an experiment on transpiration. Two young shoots of the same species are balanced on the scale and left to stand for 10 hours.

One or both sides of the leaves are covered in grease. Any difference in mass causes the heavier end to be lower.



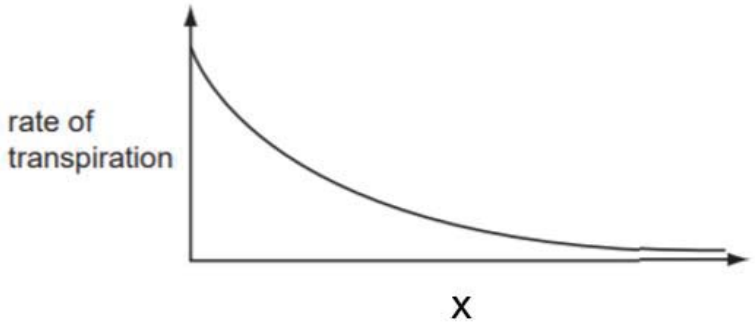
The experiment was repeated for a second set of shoots as shown in the table.

experiment	plant conditions	
1	Shoot **W** no grease applied	Shoot **X** both leaf surfaces covered with grease
2	Shoot **Y** upper leaf surfaces covered with grease	Shoot **Z** lower leaf surfaces covered in grease

At the start of the experiments, the scale was level.
For each set of experiments, which shoot will be lower after 10 hours?

	experiment 1	experiment 2
A	shoot **W**	shoot **Y**
B	shoot **W**	shoot **Z**
C	shoot **X**	shoot **Y**
D	shoot **X**	shoot **Z**

12 The graph shows how the rate of transpiration is affected by X.



What is X?

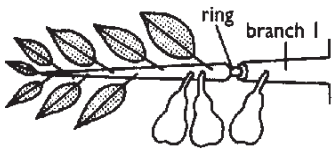
A humidity

B light intensity

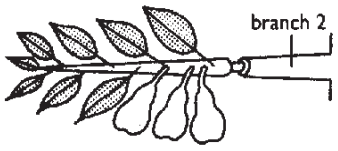
C soil moisture

D temperature

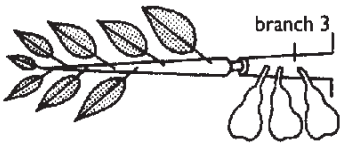
13 A ringing experiment was tried by a fruit grower attempting to produce unusually large pears. Which branch would produce the highest total mass of the three pears several months later?



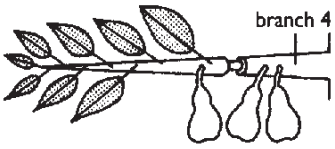
A



B



C



D

14 Blood samples from three blood vessels in the body were tested for the concentration of glucose, oxygen and urea. The results in arbitrary units are shown in the table below.

blood vessel	glucose concentration	oxygen concentration	urea concentration
1	10.3	56	3.2
2	6.8	100	7.5
3	7.2	51	2.4

Which blood vessels were the blood sampled from?

	aorta	hepatic portal vein	renal vein
A	1	2	3
B	2	3	1
C	2	1	3
D	3	2	1

15 The following are some reversible reactions that occur in our body in the transport of carbon dioxide and oxygen.

reaction	equation
I	haemoglobin + oxygen ↔ oxyhaemoglobin
II	carbon dioxide + water ↔ carbonic acid
III	carbonic acid ↔ hydrogen ion + bicarbonate

Which reactions occurs with the aid of an enzyme and within red blood cells?

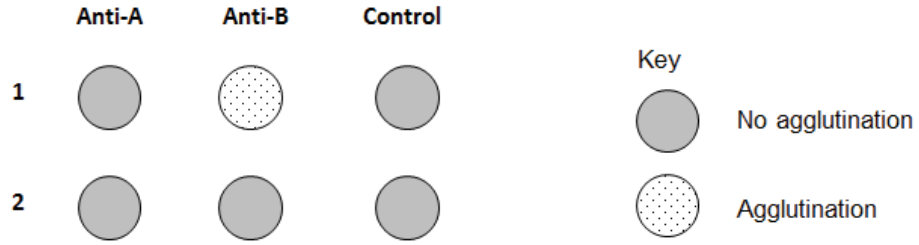
A I and II

B I and III

C II only

D III only

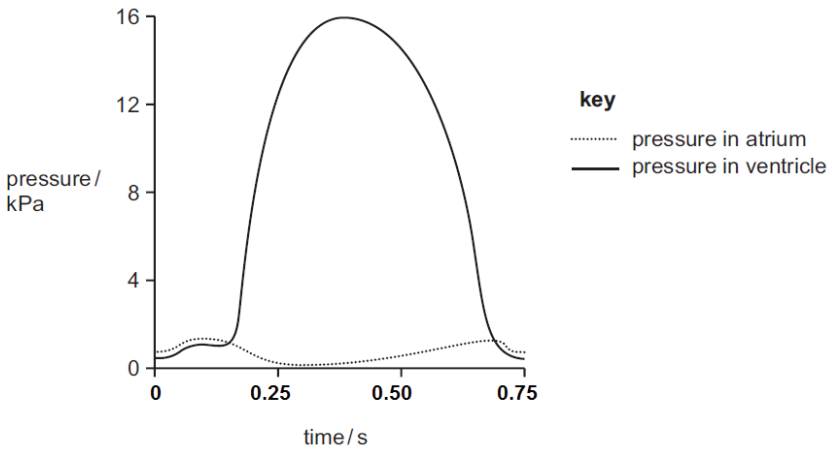
16 The blood type test results of two blood samples, **1** and **2**, are shown below.



Which correctly identifies the blood groups of samples **1** and **2**?

	sample 1	sample 2
A	A	AB
B	A	O
C	B	AB
D	B	O

17 The graph below shows the pressure changes in the left side of the heart, while at rest, during a single heartbeat.



What is the heart rate?

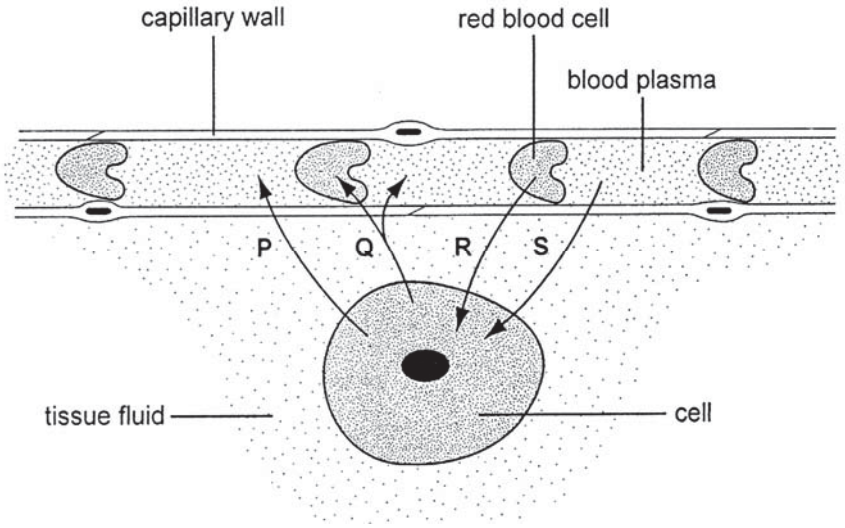
A 60 beats per minute

B 75 beats per minute

C 80 beats per minute

D 100 beats per minute

18 The diagram represents the relationship between a respiring cell and a blood capillary. The arrows indicate the direction followed by substances exchanged between the capillary contents and the cell.

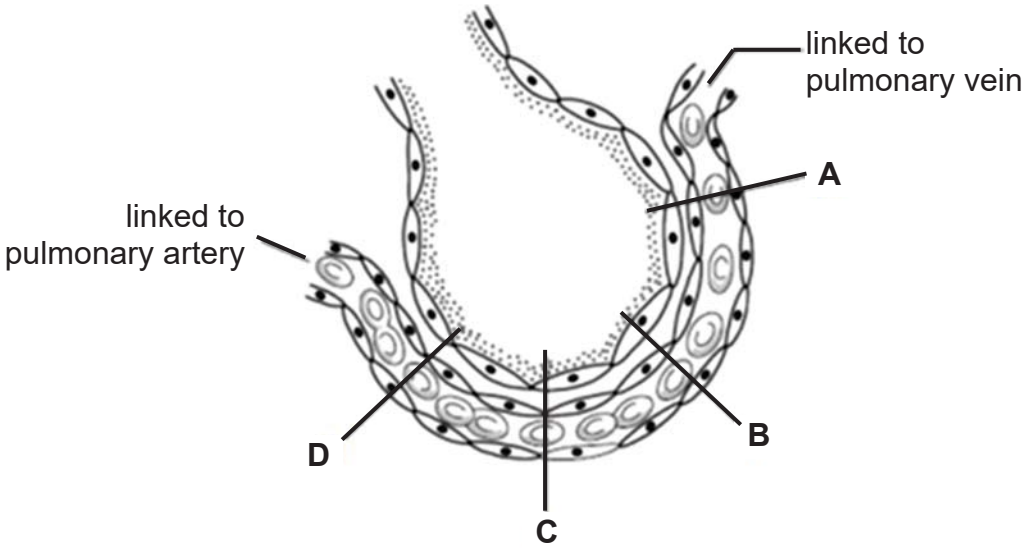


What could arrows P, Q, R and S represent?

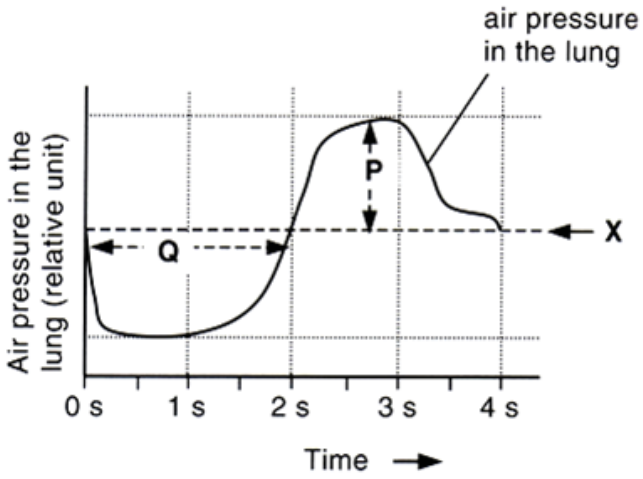
	P	Q	R	S
A	ammonia	oxygen	carbon dioxide	bicarbonate ions
B	salts	carbon dioxide	bicarbonate ions	ammonia
C	urea	salts	oxygen	plasma
D	water	carbon dioxide	oxygen	glucose

19 The diagram shows an alveolus and an associated blood capillary.

At which point will the greatest rate of diffusion of carbon dioxide molecules occur?



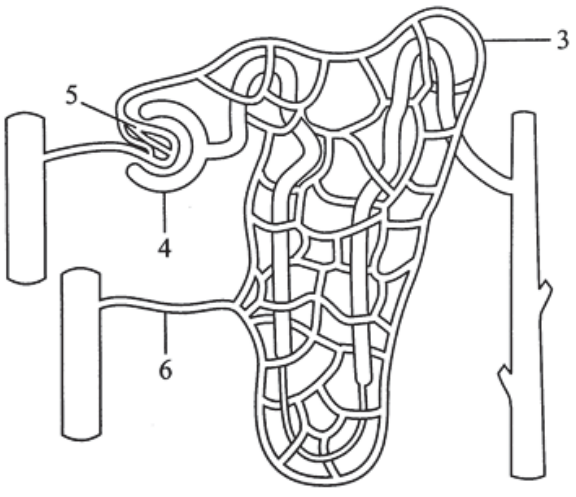
20 The graph below shows the change in air pressure in the lung during breathing of a resting person.



Which correctly states the conditions of the external intercostal muscles and the diaphragm from 0 s to 1 s?

	external intercostal muscle	diaphragm
A	relaxed	domed
B	relaxed	flattened
C	contracted	domed
D	contracted	flattened

21 The diagram below shows a nephron and its associated blood vessels.



Which numbered part has the highest blood pressure?

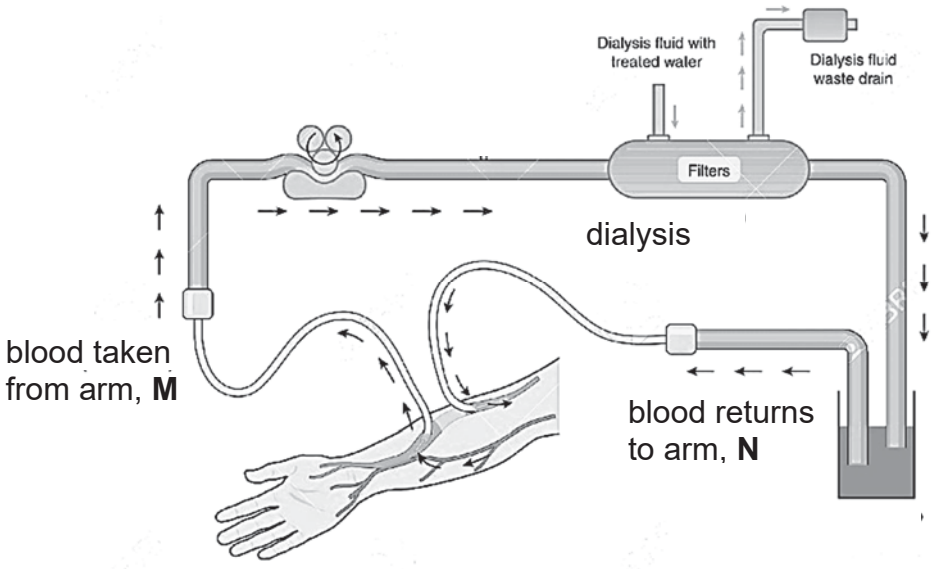
A 3 **B** 4

C 5 **D** 6

22 Which shows the substances ultra-filtered and selectively reabsorbed into the kidney tubules of a healthy human?

	ultra-filtered from blood	some selectively reabsorbed into blood	all selectively reabsorbed into blood
A	salt	glucose	protein
B	water	salt	glucose
C	protein	water	salt
D	glucose	protein	water

23 A patient undergoing dialysis has blood samples taken at point **M** and **N**.



Biuret and Benedict's test was carried out on the dialysis fluid and blood samples, **M** and **N**. The results are as follow.

sample	Biuret test result	Benedict's test result
M	violet colour solution	orange-red precipitate
N	violet colour solution	orange-red precipitate
dialysis fluid	blue colour solution	orange-red precipitate

Which best explains the results?

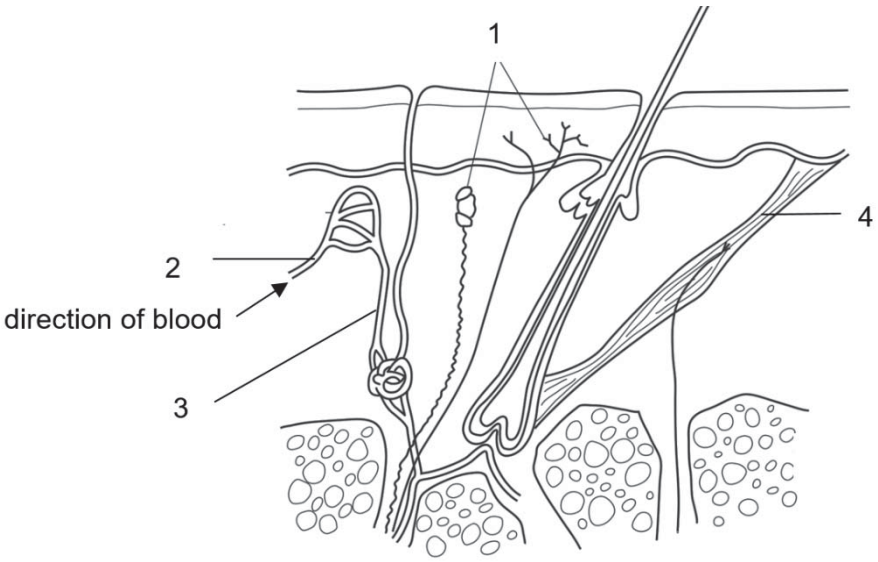
A Most glucose molecules have been removed from the patients' blood after dialysis.

B The dialysis fluid contains glucose and proteins.

C The partially permeable dialysis tubing allows proteins to pass through but not glucose.

D Proteins are too big to pass through the partially permeable dialysis tubing.

24 The diagram below shows some structures in a section through human skin.

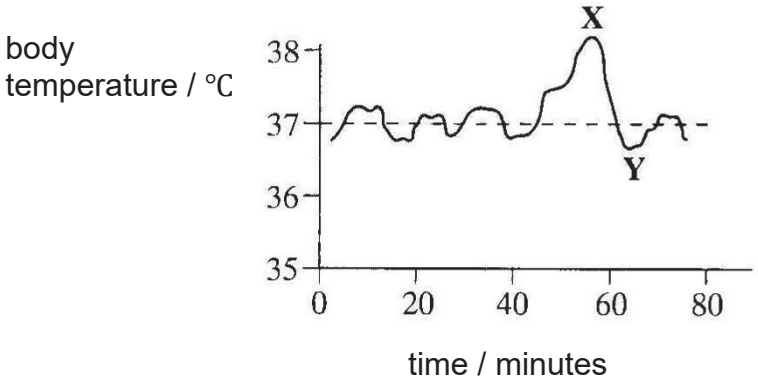


Which structures contain muscles that contract when a person walks out into the snow from a ski resort?

A 1 and 2 **B** 1 and 3

C 2 and 4 **D** 3 and 4

25 The graph below shows changes in a person's body temperature plotted against time.



What causes the change in temperature between **X** and **Y**?

A increased evaporation of sweat

B reduced blood flow to skin

C shivering

D vasoconstriction of blood vessels under the epidermis

26 The table below compares the endocrine and nervous control.

	comparison	endocrine control	nervous control
1	control	involuntary	voluntary
2	effect	localised	wide area
3	speed of response	slower	faster
4	transmission	by blood	by nerve impulses

Which of the comparisons are correct?

A 1, 2 and 3

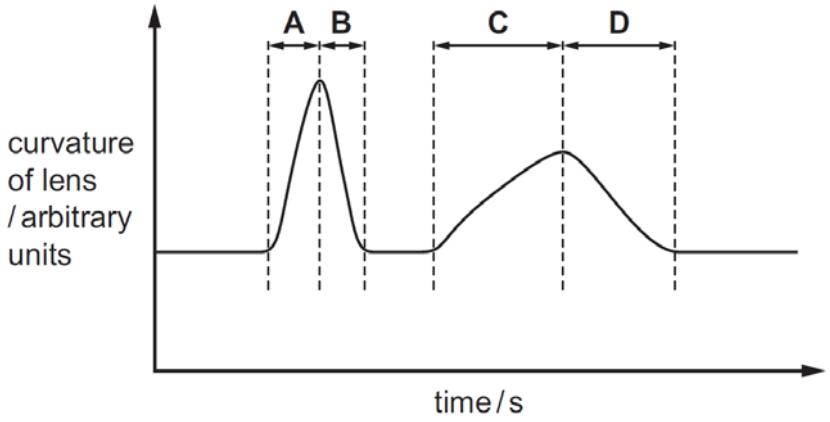
B 1, 2 and 4

C 1, 3 and 4

D 2, 3 and 4

27 The diagram shows the curvature of the lens in a person's eye. The shape of the lens changes as the person watches two motorbikes go past at different speeds.

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

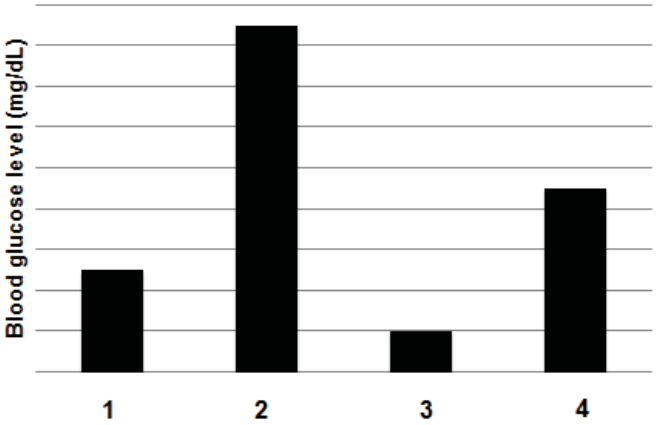


28 Four people had the following descriptions with regards to their body and dietary conditions:

- Normal; has not eaten for 24 h
- Normal; before lunch
- Normal; 3 h after lunch
- Diabetic; 3 h after lunch

They were then tested for their blood glucose levels.

The graph below shows the blood glucose levels of the 4 people.



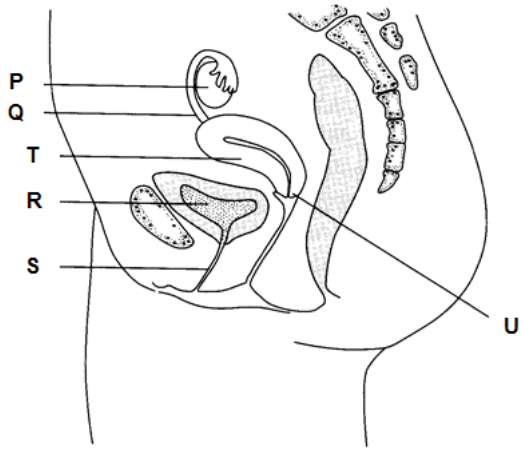
Which correctly describes for the various columns in the graph above?

	1	2	3	4
A	normal; before lunch	normal; 3 h after lunch	normal; has not eaten for 24 h	diabetic; 3 h after lunch
B	normal; has not eaten for 24 h	diabetic; 3 h after lunch	normal; before lunch	normal; 3 h after lunch
C	normal; before lunch	diabetic; 3 h after lunch	normal; has not eaten for 24 h	normal; 3 h after lunch
D	normal; 3 h after lunch	diabetic; 3 h after lunch	normal; has not eaten for 24 h	normal; before lunch

29 When a person is frightened, which responses will occur?

A	adrenaline released	heart beat increases	eye pupils dilate
B	adrenaline released	blood glucose increases	urine production increases
C	insulin released	breathing rate increases	peristalsis stops
D	insulin released	eye pupils dilate	saliva secretion stops

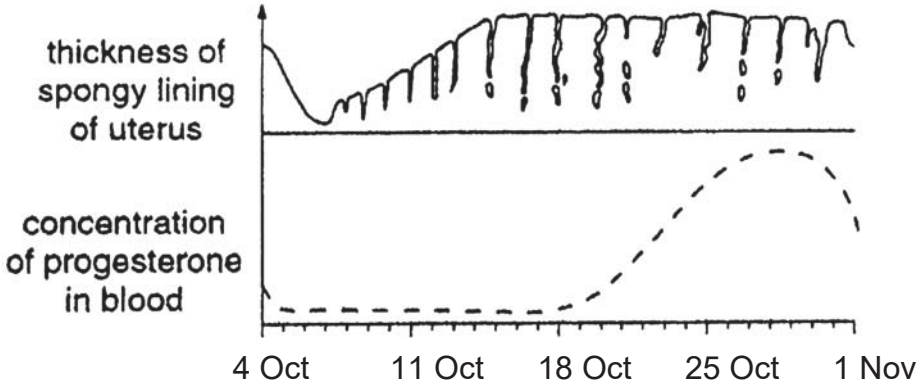
30 The diagram below shows the side view of the female reproductive system.



Which correctly identifies the events that occur in the labelled structures?

	development of foetus	storage of urine	formation of zygote
A	R	T	U
B	R	T	P
C	T	R	Q
D	T	P	R

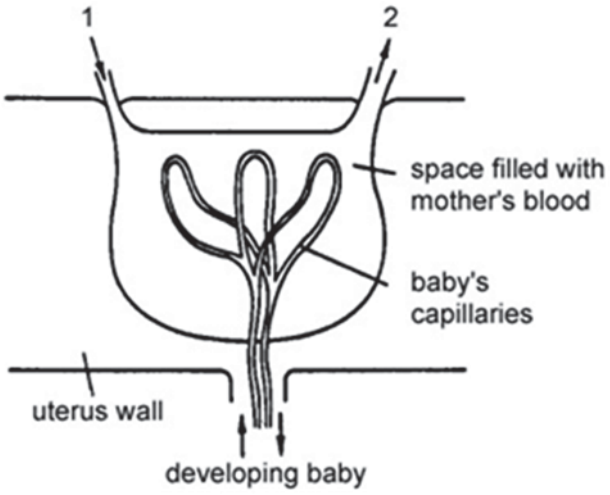
31 The diagram below shows changes in the thickness of the uterus lining as well as changes in progesterone concentration during a menstrual cycle.



When did ovulation occur and what event is most likely to occur after 25 Oct?

	date of ovulation	event most likely to occur
A	11 Oct	implantation
B	11 Oct	menstruation
C	18 Oct	implantation
D	18 Oct	menstruation

32 The diagram below shows the arrangement of blood vessels in the uterus and placenta of a female mammal.



Which about the blood flowing in blood vessel 1 and 2 is correct?

	1	2
A	high amino acids concentration	low amino acids concentration
B	high carbon dioxide concentration	low carbon dioxide concentration
C	low oxygen concentration	high oxygen concentration
D	low glucose concentration	high glucose concentration

33 Choon Hwee and Marcella made four statements about themselves.

	Choon Hwee	Marcella
1	I am a boy.	I am a girl.
2	I am 160 cm tall.	I am 155 cm tall.
3	I am a good swimmer.	I am good at badminton.
4	My blood group is B.	My blood group is AB.

Which statements describe characteristics that show discontinuous variation?

A 1 and 2 **B** 1 and 4

C 2 and 3 **D** 3 and 4

34 Phenylketonuria (PKU) is an autosomal recessive genetic disorder characterized by a deficiency in the enzyme phenylalanine hydroxylase (PAH).

Two parents of blood group O and blood group AB, have a child who is blood group A and suffered from PKU. Neither of the parents suffered from PKU.

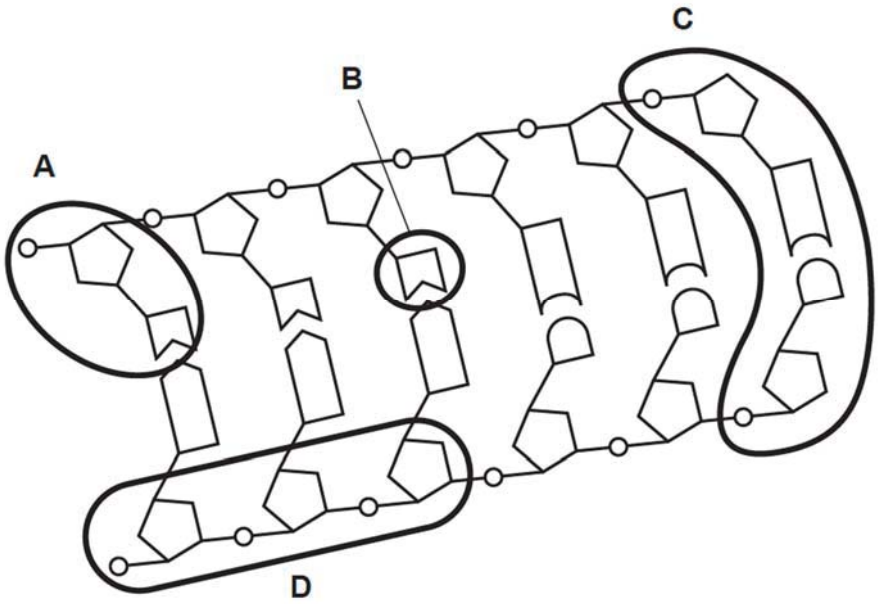
What is the probability for these parents to have a second child with blood group B who does not suffer from PKU?

A 1 in 16 **B** 1 in 8

C 3 in 16 **D** 3 in 8

35 The figure shows part of a DNA molecule.

Which is a nucleotide?



36 When DNA was extracted from *E.coli* cells and analysed for base composition, it is found that 38% of the bases are cytosine.

What percentage of the bases is adenine?

A 12 % **B** 24 %

C 38 % **D** 62 %

37 The diagram shows the nucleotide sequence of a small section of a gene which is transcribed.

CGCCGCACGCGC

The table shows the amino acids coded for by 10 mRNA codons.

mRNA codon	amino acid
AAG	Lys
ACG	Thr
CGG CGC CGU	Arg
CCG	Pro
GCC GCG	Ala
GGC	Gly
UGC	Cys

What is the order of the four amino acids in the polypeptide translated from this small section of a gene?

A Ala-Ala-Cys-Ala

B Ala-Arg-Gly-Ala

C Arg-Ala-Pro-Arg

D Arg-Arg-Thr-Arg

38 The following lists the steps needed to insert the insulin gene into a bacteria cell.

1 identify the insulin gene
2 ligate sticky ends to the plasmid
3 introduce the plasmid into bacteria
4 cut the plasmid using restriction enzyme
5 cut out the gene using restriction enzymes

Which is the correct sequence of the process?

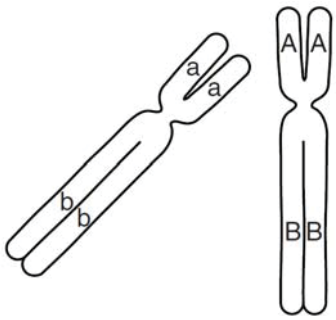
A 5 → 1 → 3 → 2 → 4

B 1 → 4 → 5 → 2 → 3

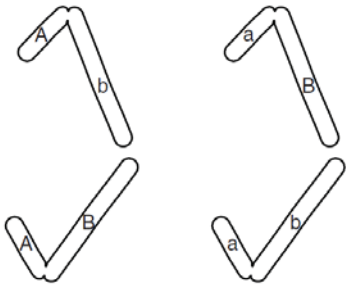
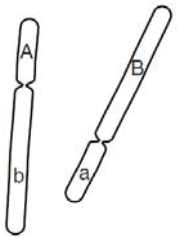
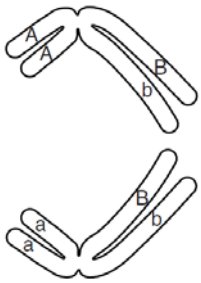
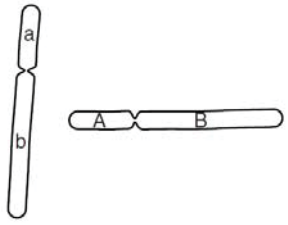
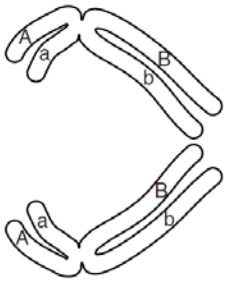
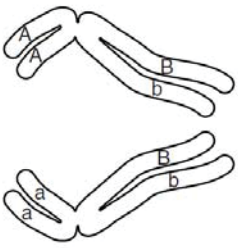
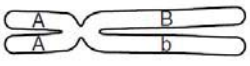
C 4 → 3 → 5 → 2 → 1

D 3 → 2 → 4 → 1 → 5

39 The diagram shows two homologous chromosomes in early prophase I of meiosis in a human cell. The position of two genes, **A**/**a** and **B**/**b**, on the homologous chromosomes are also shown.



Which row of diagrams is a possible representation of these chromosomes as they progress from anaphase I to prophase II?

	anaphase I	prophase II
A		
B		
C		
D		

40 The common eastern firefly *Photinus pyralis* has 10 chromosomes in its egg cell.

Which row correctly shows the number of chromosomes in a *Photinus* cell at the end of mitosis, meiosis I and meiosis II?

	number of chromosomes after mitosis	number of chromosomes at the end of meiosis I	number of chromosomes at the end of meiosis II
A	10	10	10
B	10	20	20
C	20	10	10
D	20	10	20

- END OF PAPER -

BEDOK SOUTH SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2020

4EXP

CANDIDATE NAME

CLASS | INDEX NUMBER

BIOLOGY

6093/02

Paper 2

28 August 2020

1 hour 45 minutes

Candidates answer on the Question Paper.
No Additional Materials are required

READ THESE INSTRUCTIONS FIRST

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

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

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

Electronic calculators may be used.

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

For Examiner's Use	
Paper 1 (40)	
Paper 2	
Section A	
Section B	
Paper 3 (40)	
Total (100)	

Setter: Ms. Nancy Sim

This document consists of **21** printed pages including this cover page.

[Turn Over

For Examiner's Use

Section A

Answer **all** questions.

Write your answers in the spaces provided.

1 Fig. 1.1 is a diagrammatic representation of the small intestine containing three types of food substances, a fat, a carbohydrate and a protein, before they are digested. Fig. 1.1 also shows a lacteal and a capillary. The different features in Fig. 1.1 are not drawn to scale.

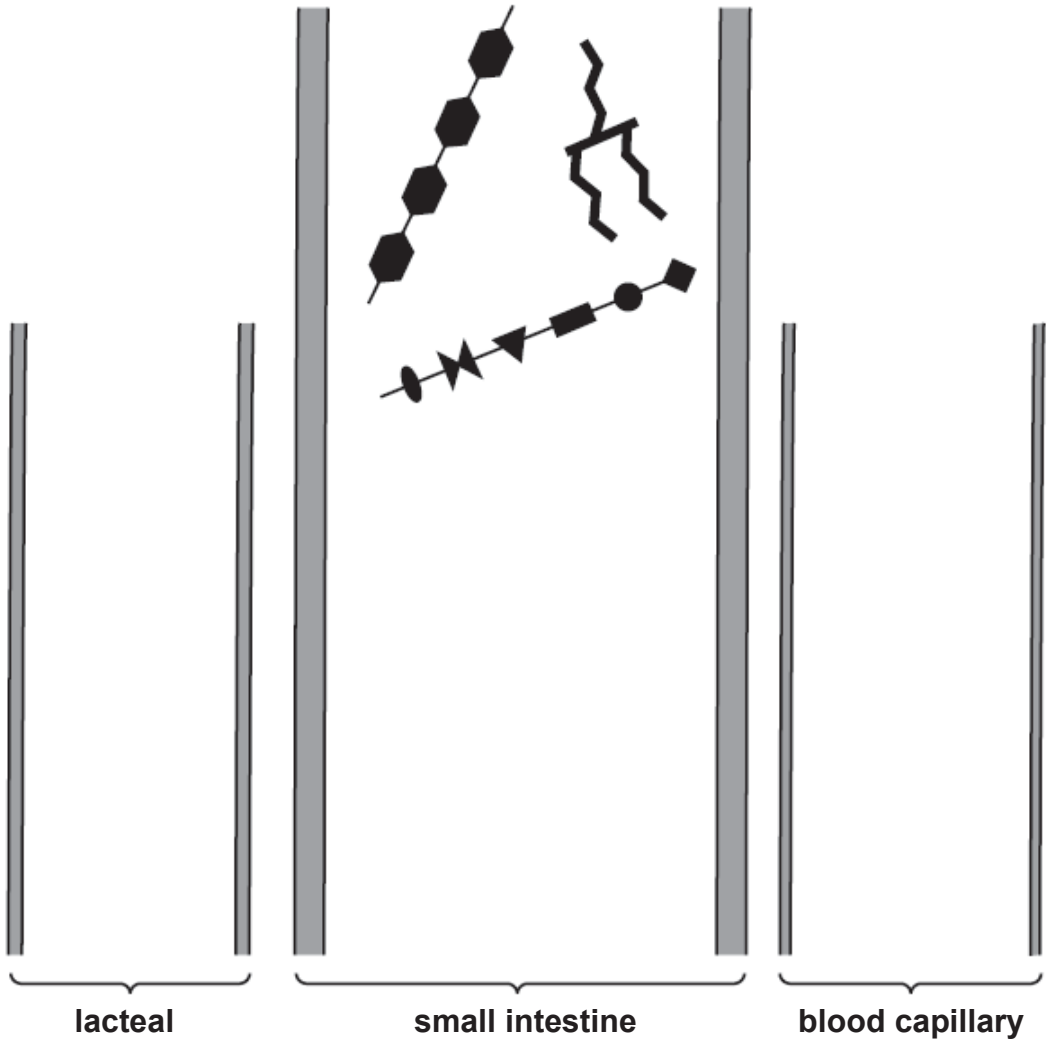


Fig. 1.1

(a) On Fig. 1.1, draw and label the molecules as they would appear after they have been digested and then absorbed by the lacteal and by the capillary. [3]

(b) **(i)** State the name of the blood vessel that transports the blood from the small intestine to the liver.

……..……..... [1]

(iii) Describe what happens to excess digested food molecules in the liver.

……..……......

……..……......

……..……......

……..……......

……..……......

……..……..... [3]

[Total: 7]

2 Fig. 2.1 shows an apparatus used to investigate the effect of light intensity on the rate of photosynthesis using a cut shoot of a pond plant.

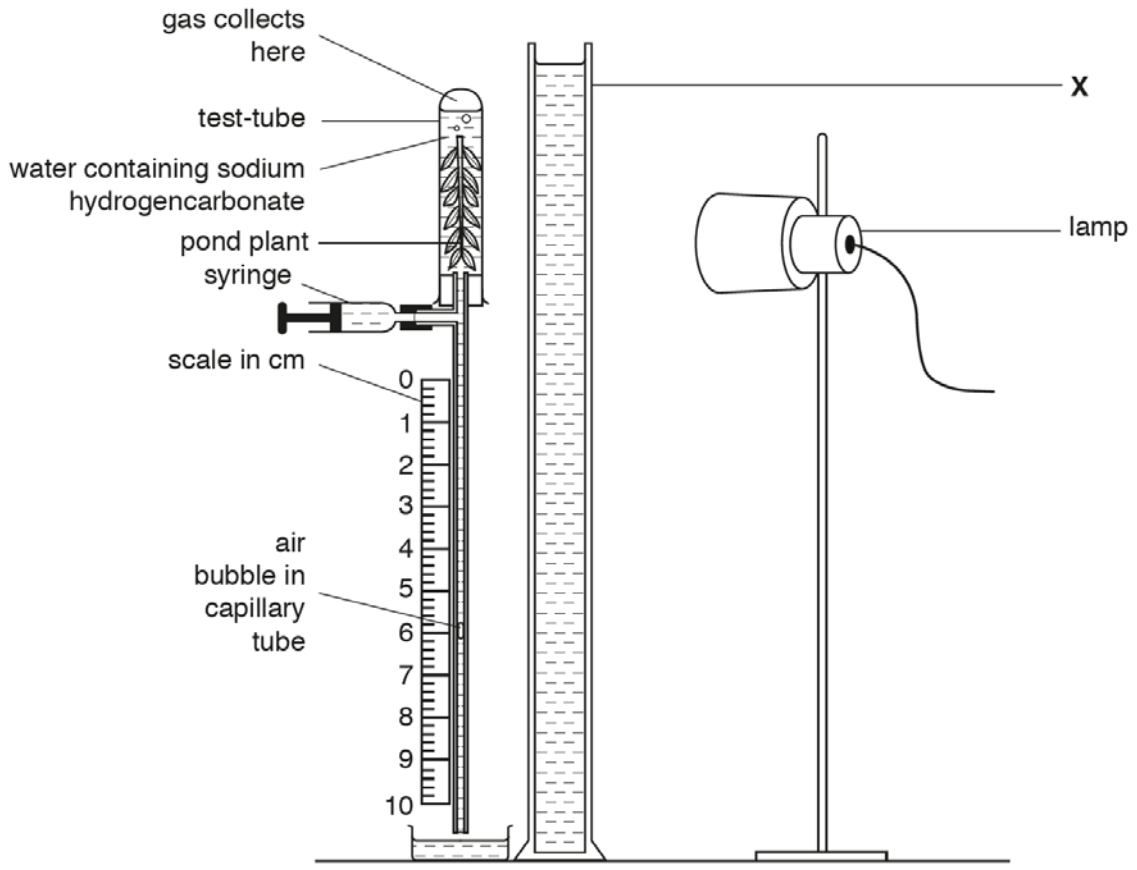


Fig. 2.1

(a) Sodium hydrogencarbonate was added into the water in the test-tube before the apparatus was completely assembled. Suggest why hydrogencarbonate was added into the water.

……

…… [1]

(b) The investigation was carried out with the lamp at distances of 10, 20, 30, 40 and 50 cm from the pond plant. For each of these distances, the air bubble in the capillary tube was initially positioned at 0 cm on the scale and the distance moved by the air bubble was measured after 5 minutes. The rate of movement of the air bubble was then calculated and the results are plotted on a graph shown in Fig. 2.2.

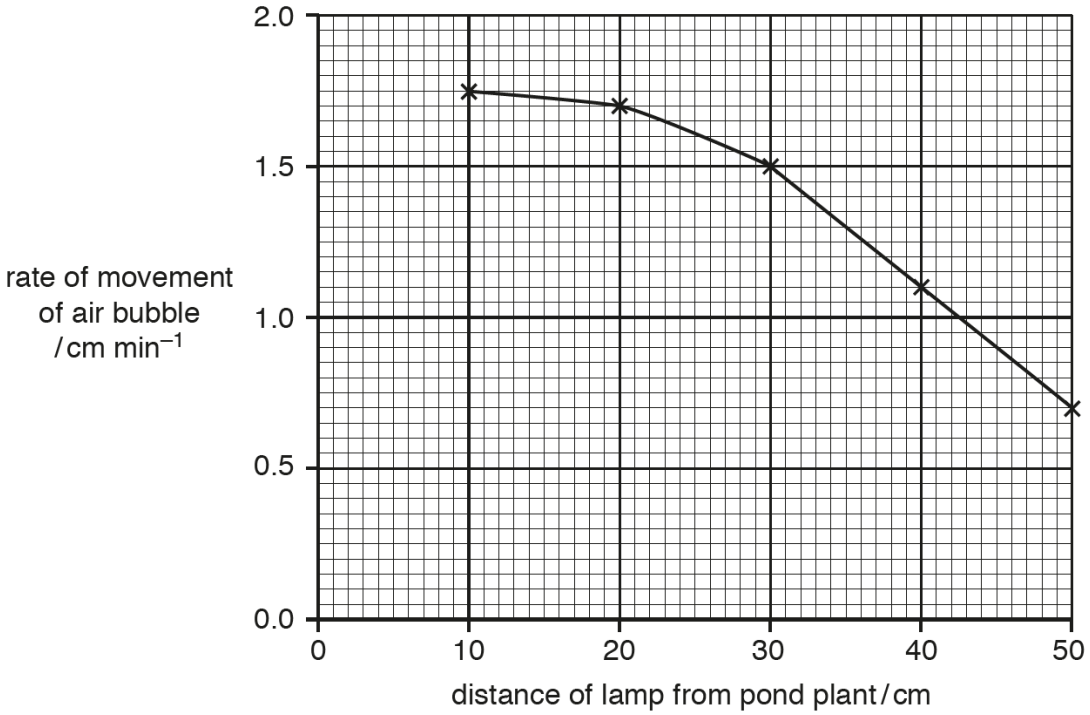


Fig. 2.2

(i) Suggest how the rate of movement of air bubble was calculated.

……

…… [1]

(ii) Using information from Fig. 2.2, describe the relationship between the rate of photosynthesis and light intensity.

……

……

……

…… [2]

(iii) The rate of movement of the air bubble when the distance between the lamp and the pond plant was less than 10 cm was the same as that at 10 cm. Explain why this is so.

……

…… [1]

[Total: 5]

3

(a) Fig. 3.1 shows the pressure changes in the left side of the heart for a single heartbeat.

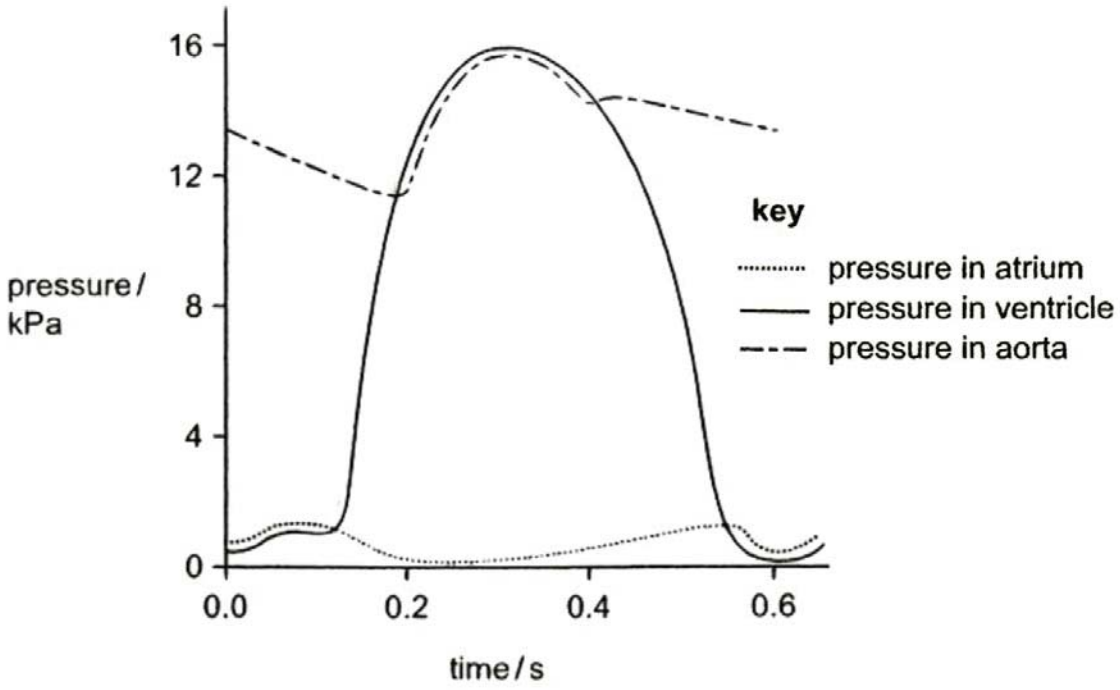


Fig. 3.1

(i) State the time when the aortic valve starts to open.

…… [1]

(ii) With reference to Fig. 3.1, describe and explain the pressure changes in the left ventricle from 0.1 s to 0.3 s.

……

……

……

…… [2]

(iii) Explain why the ventricular pressure on the right side of the heart is much lower during contraction as compared to the left side.

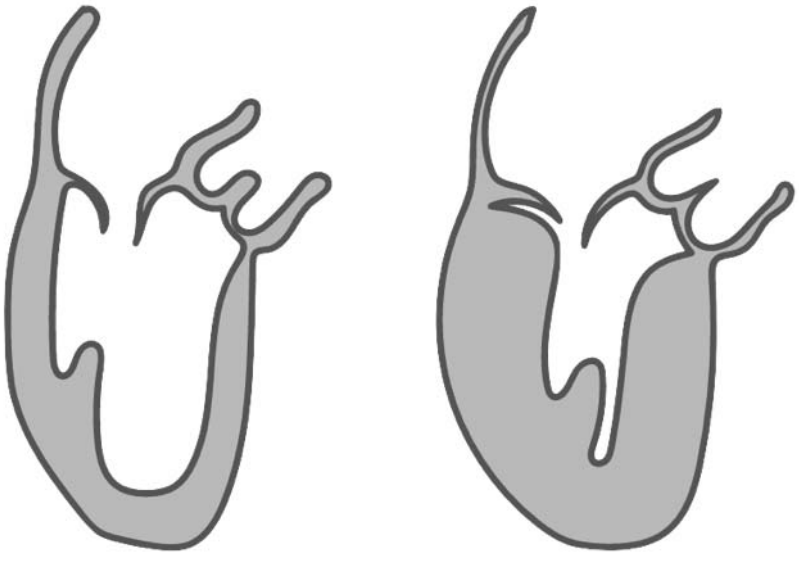
……

……

……

…… [2]

(b) Fig. 3.2 shows the left side of a normal heart and the heart of a patient with diastolic heart failure.



normal heart diastolic heart failure

Fig. 3.2

Suggest why patients with diastolic heart failure often complain of excessive tiredness.

For Examiner's Use

……

……

……

…… [2]

[Total: 7]

4 Fig. 4.1 shows a reflex arc involving a finger and a muscle in the arm.

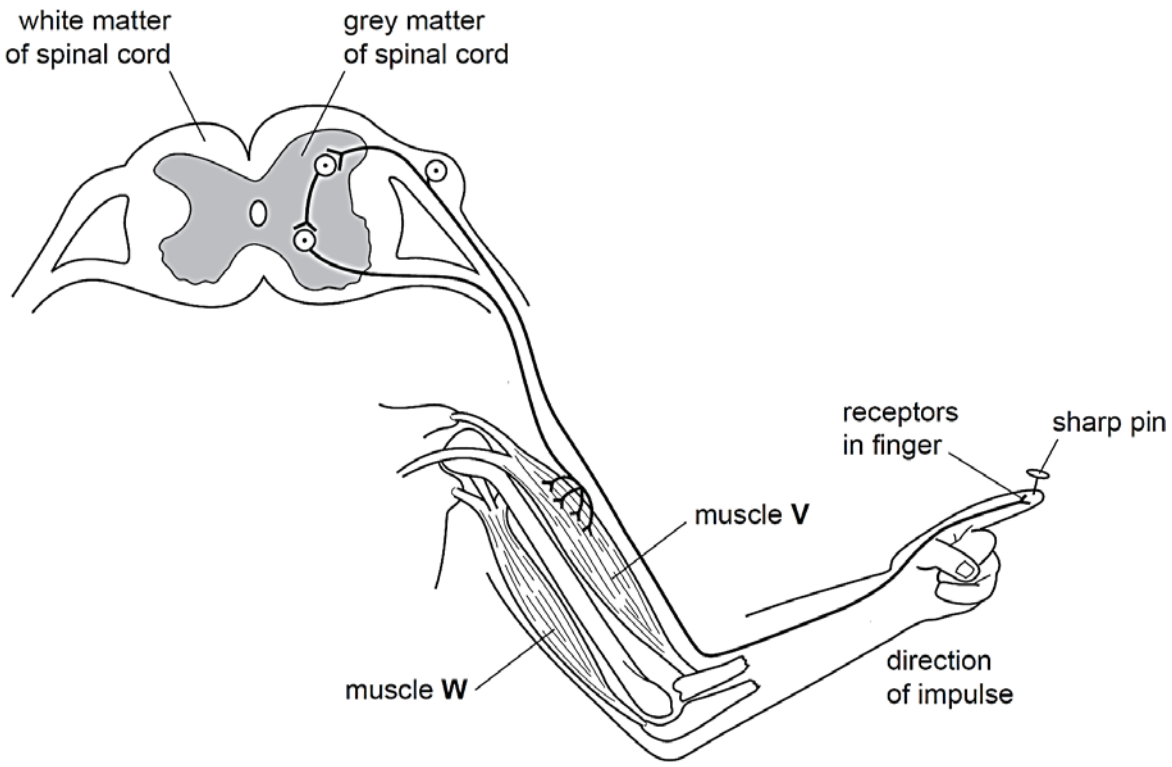


Fig. 4.1

(a) On Fig. 4.1, label

(i) a sensory neurone, and [1]

(ii) a relay neurone. [1]

(b) When the finger experiences the pinprick, nerve impulses are generated. Outline the pathway taken by the nerve impulses, from the time when they were generated, until the time when the arm was moved away from the pin.

……

……

…… [2]

[Total: 4]

5 Fig. 5.1 shows three longitudinal sections of an individual daisy flower during pollination period.

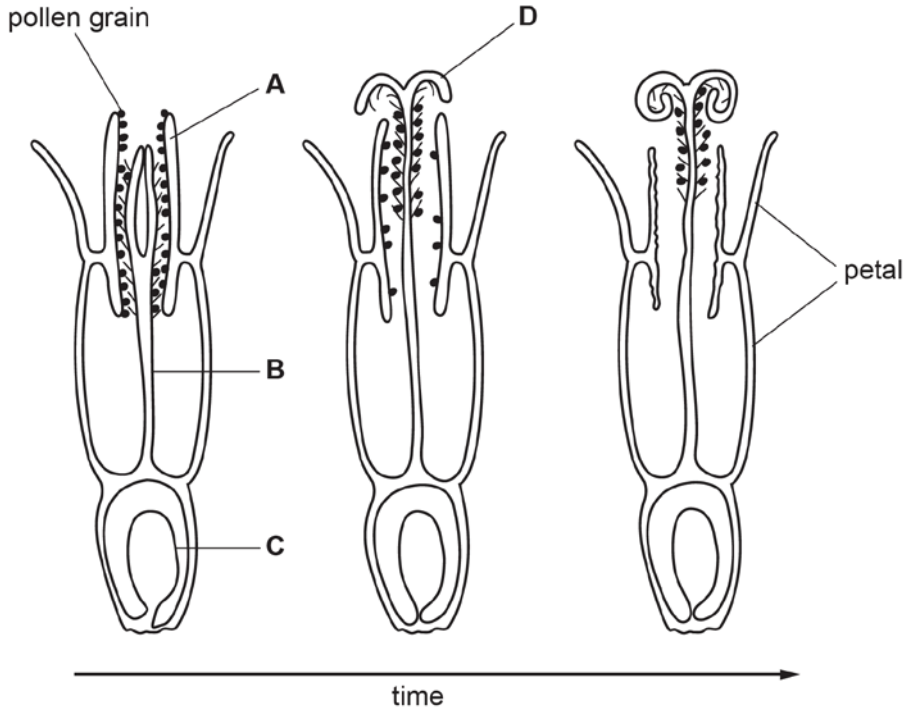


Fig. 5.1

(a) Identify the parts labelled **A** to **D**.

A …… **C** ……

B …… **D** …… [4]

(b) Daisies attract insects. The effect of insects visiting the flowers on the percentage of flowers producing seeds was investigated. Some daisies were isolated from any insect visitation while others received between one and 50 insect visits.

The percentage of flowers that produced seeds are shown in Table 5.1.

Table 5.1

number of insect visits	percentage of flowers producing seed
0	90
1	90
10	92
20	95
50	95

(i) Using information from Fig. 5.1, suggest an explanation for the data shown in Table 5.1.

……

……

……

…… [2]

(ii) Suggest, with a reason, whether there is likely to be any difference in the genetic variation shown by the seeds of daisies receiving many insect visits and those receiving none.

……

……

……

…… [2]

[Total: 8]

For Examiner's Use

6 The gene that codes for hair type in guinea pigs is located on a non-sex chromosome. This gene has two alleles, smooth (**r**) and rosette (**R**) as shown in Fig. 6.1. A pure-breed guinea pig with smooth hair was mated with a pure-breed guinea pig with rosette hair and all the offspring have rosette hair.

smooth hair

rosette hair

Fig. 6.1

(a) Distinguish between the terms *gene* and *allele*.

.....

.....

.....

..... [2]

(b) One offspring from the parents shown in Fig. 6.1 was then mated with the smooth hair parent. Using the symbols given above, draw a genetic diagram to show the outcome of this cross.

[5]

(c) A mutation occurred in one of the offspring from the parents shown in Fig. 6.1, resulting in a nearly hairless guinea pig.

(i) State the term that is used to describe the physical trait of an organism.

……..……..... [1]

(ii) Describe how the mutation caused a change in the growth of hair.

……

……

……

……

……

…… [3]

[Total: 11]

7 The photomicrographs in Fig. 7.1 show some stages of cell division in a flower of a lily, *Lilium candidum.*

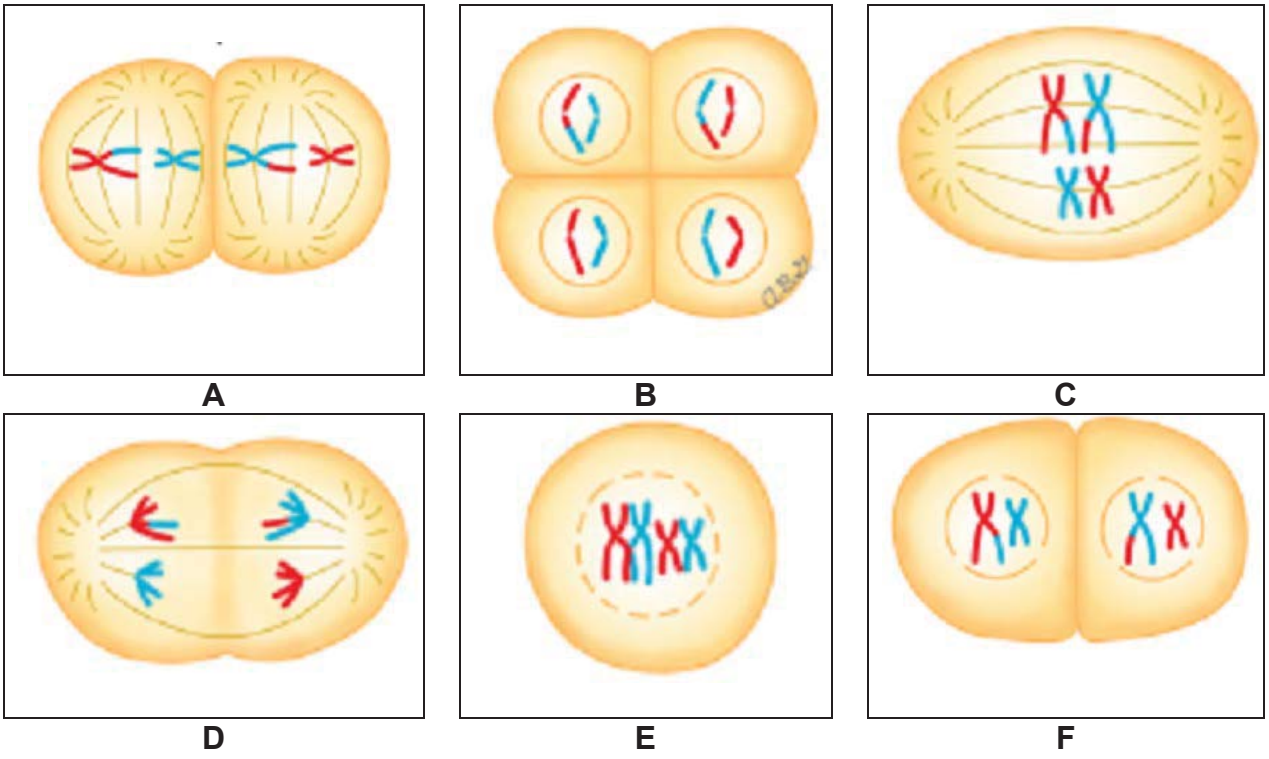


Fig. 7.1

(a) **(i)** Identify the type of cell division shown.

…… [1]

(ii) State a part of the flower that undergoes the cell division shown.

…… [1]

(iii) Write the letters in the order the stages would occur.

1 **E** 2 ……. 3 ……. 4 ……. 5 ……. 6 ……. [1]

(b) Use your knowledge of cell division to describe two differences between the arrangements of chromosomes in stages **A** and **C**.

……

……

……

……

……

…… [3]

(c) State how the type of cell division shown can result in variation in the lily, *Lilium candidum.*

……

……

……

…… [2]

[Total: 8]

Section B

For Examiner's Use

Answer **all three** questions.

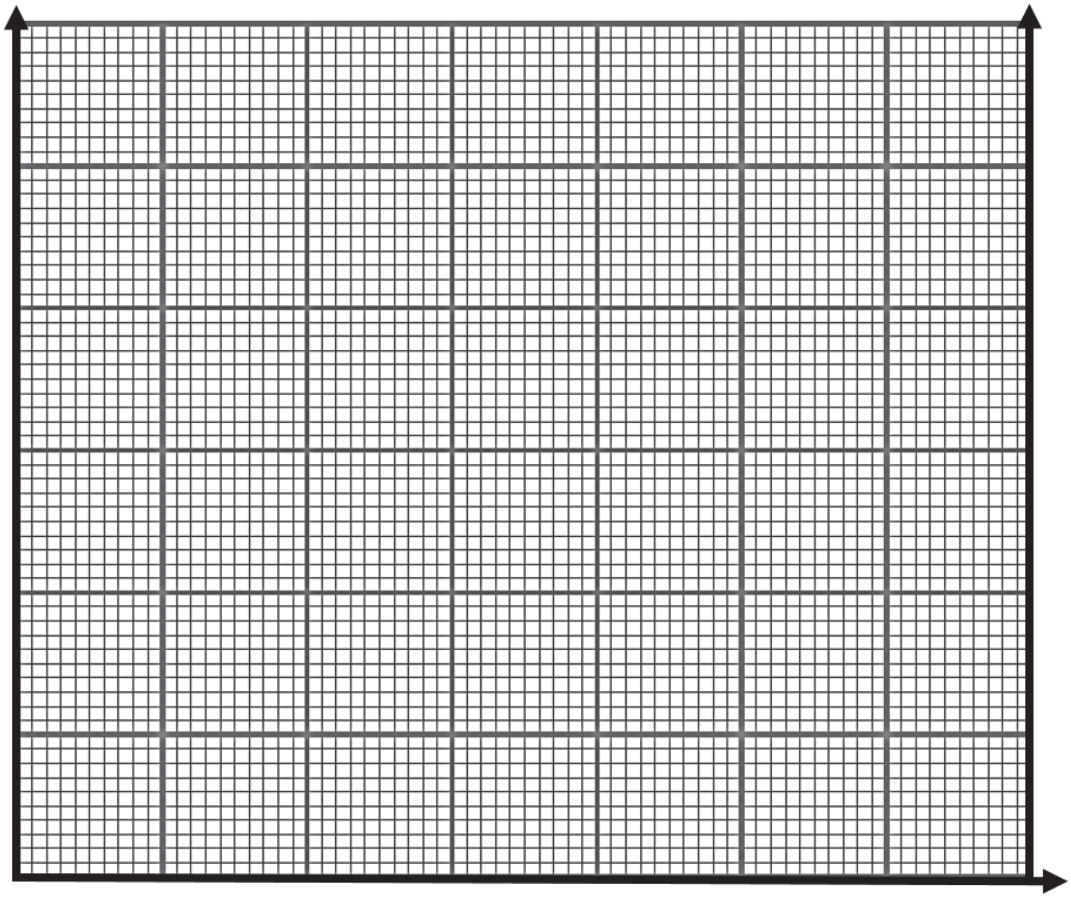
8 In an experiment, a person was kept in complete darkness for 30 minutes. After that time the sensitivity of the person's retina to different wavelengths of light was measured.

Table 8.1 shows the results of the experiment.

Table 8.1

wavelength of light/ nm	420	440	460	480	500	520	540	560	580	600
sensitivity of retina/ arbitrary units	5	15	35	65	100	74		25	15	5

(a) Plot a graph to show the data in Table 8.1.



[3]

(b) Calculate the change in the sensitivity of the retina when the wavelength of light increased from 440 nm to 500 nm.

…… [1]

(c) Describe and explain the relationship between the sensitivity of the retina and the wavelength of light.

……

……

……

…… [2]

(d) No measurement was taken at 540 nm. Use your graph to estimate the sensitivity of the retina at a wavelength of 540 nm. Mark this point on your graph and rewrite the value here.

Sensitivity of the retina at 540 nm…… arbitrary units [1]

(e) During the investigation, the diameter of the pupils of the eyes decreased.

Explain how the decrease in the diameter of the pupils was brought about.

……

……

……

……

……

…… [3]

[Total: 10]

For Examiner's Use

9

(a) Suggest and explain the impact(s) on a person when part of the large intestine is surgically removed due to an infection of the gastrointestinal tract.

……

……

……

……

……

…… [3]

(b) The influenza virus produces an enzyme called neuraminidase which breaks down glycoproteins in the membrane of the cell that the virus infects.

Use your understanding of the lock and key model of enzyme action to explain how the virus is able to break down the cells.

……

……

……

……

……

……

……

…… [3]

(c) Investigations have shown that temperature has an effect on the urine production in humans.

Describe and explain the relationship between air temperature and urine production.

……

……

……

……

……

……

……

…… [4]

[Total: 10]

For Examiner's Use

10 Fig. 10.1(a) and Fig. 10.1(b) show graphs of the pulse and breathing rates of two students, **E** and **F**, during and after one minute's vigorous exercise.

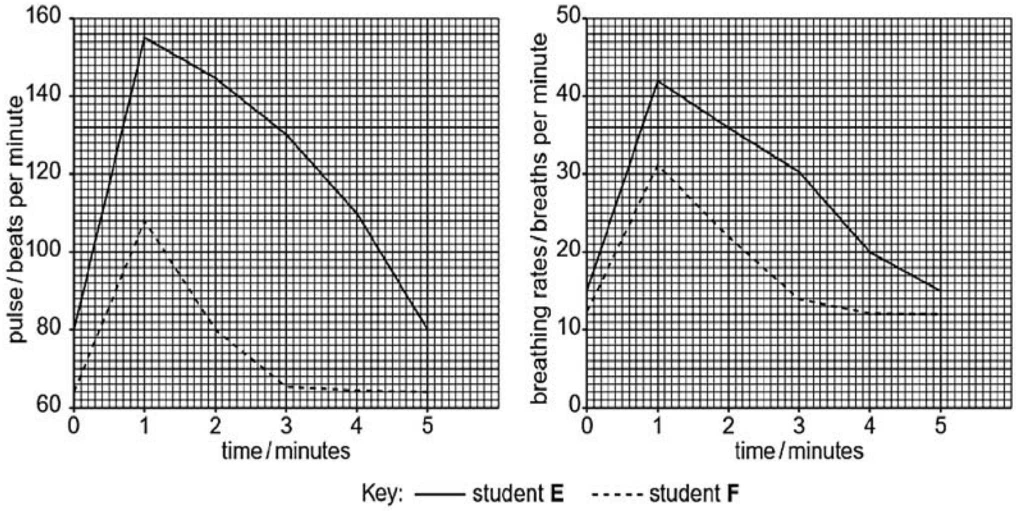


Fig. 10.1 (a) **Fig. 10.1 (b)**

(a) State how long it took for student **F**'s pulse and breathing rates to return to their original levels after the student had finished exercising.

pulse rate: ……………………………………….

breathing rate: ………………………………….. [2]

(b) Explain why the pulse and breathing rates of both students increased during exercise.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

…………………………………………………………………………………………………… [4]

(c) Suggest and explain possible reasons for the differences in the effect of vigorous exercise on these two students.

For Examiner's Use

……

……

……

……

……

……

……

…… [4]

[Total: 10]

- END OF PAPER -

BEDOK SOUTH SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2020
Secondary 4 Express
Biology 6093/1 and 6093/2
Marking Scheme

Paper 1

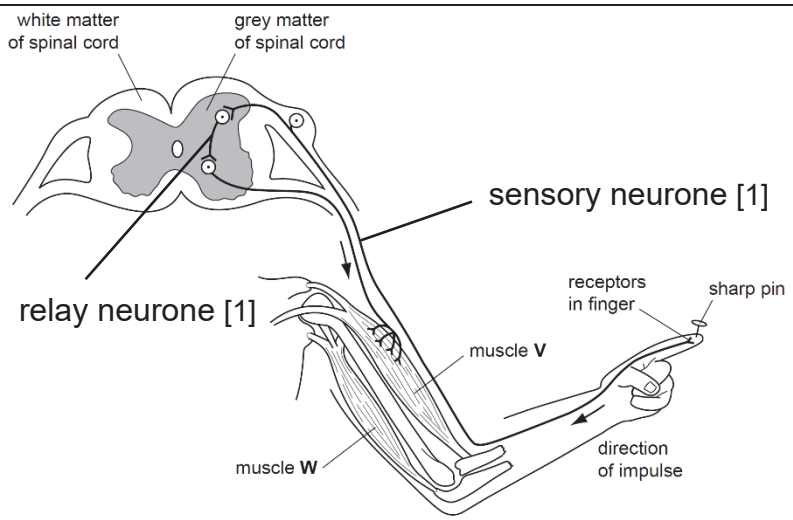
Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
A	B	B	B	D	D	B	C	B	A
Q11	**Q12**	**Q13**	**Q14**	**Q15**	**Q16**	**Q17**	**Q18**	**Q19**	**Q20**
D	A	B	C	C	D	C	D	D	D
Q21	**Q22**	**Q23**	**Q24**	**Q25**	**Q26**	**Q27**	**Q28**	**Q29**	**Q30**
C	B	D	C	A	C	A	C	A	C
Q31	**Q32**	**Q33**	**Q34**	**Q35**	**Q36**	**Q37**	**Q38**	**Q39**	**Q40**
D	A	B	D	A	A	A	B	D	C

Paper 2

Section A (50 marks)

Qn no.		Suggested answer	Comments to markers	Marks
1	a	• Products drawn in correct absorptive vessel. One correctly drawn and labelled product is 1 mark/ 2 correctly drawn 1 mark. • ***All molecules must be completely digested and a minimum of 2 products of each type is required to get the mark***		3
		• *Most able to recall the regions of absorption for each nutrients but unable to show complete digestion of molecules.*		
	c (i)	• hepatic portal vein [1]		1
		• *Well answered.*		
	c (ii)	• Excess amino acids undergo deamination in the liver [1] • and are broken down to form urea and glucose [1]. • Excess glucose in the blood is converted by insulin into glycogen which is stored in the liver [1]		3
		• *Some stated excess proteins that undergo deamination.* • *A few were still confused between the action of insulin and glucagon.* • *Some gave very brief and incomplete which are not specific enough.*		
2	a	• source of carbon dioxide; • carbon dioxide is a substrate/ raw material of photosynthesis; [1]		1

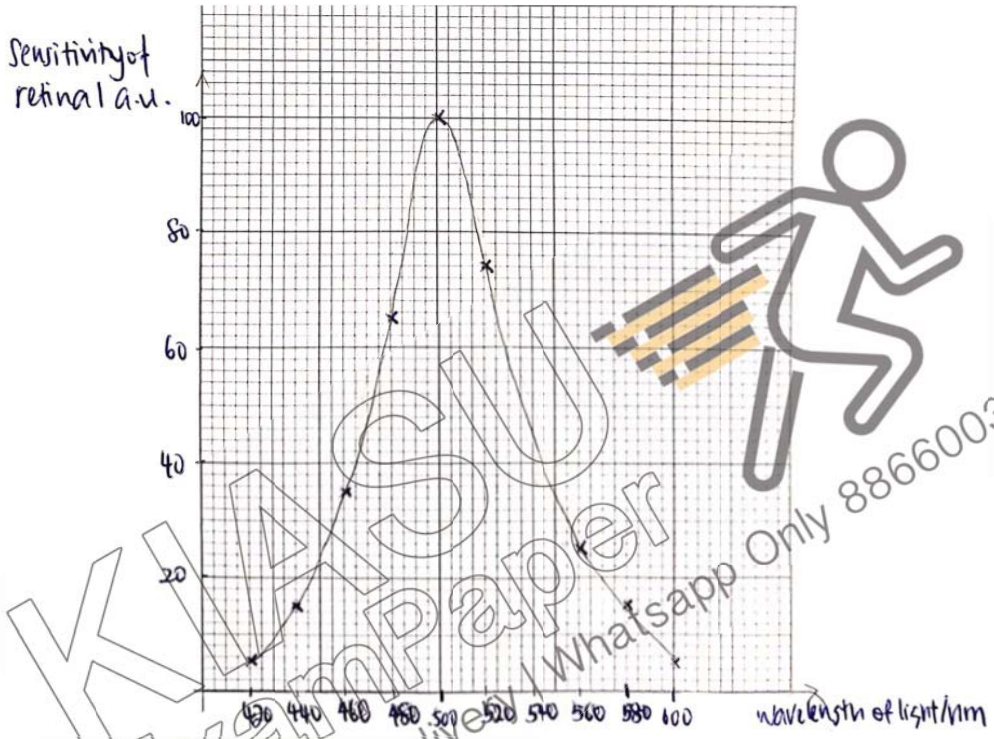
		•		
	b (i)	• distance moved by air bubble / 5 minutes; [1]		1
		•		
	b (ii)	• as light intensity increases the rate of photosynthesis increases / ora; [1] • data quote (two values of rate of movement of air bubble plus two values of distance of lamp from pond, plus units); [1]		2
		•		
	b (iii)	• At less than 10 cm between the lamp and the pond plant, enzymes could be denatured. [1] • Other factors become limiting e.g. temperature.		1
		•		
3	a (i)	• Any answer from 0.18s - 0.2s	*R: answers without units*	1
		•		
	a (ii)	• From 0.1s to 0.3s, pressure in the ventricle increases • From 1 kPa to 16 kPa; [1] • As the muscles of the ventricle contract; [1] *(-1m if no data quoted)*		2
		• *Most did not quote data from diagram to support answer.* • *Those who gave a general trend did not explain.*		
	a (iii)	• The right ventricle only needs to pump blood to the lungs over a shorter distance; [1] • Has thinner muscular walls compared to left ventricle as less force, less pressure required; [1]		2
		• *Most left out on the distance to be pumped*		
	b	• The left ventricle is unable to relax and fill with sufficient blood / smaller volume in left ventricle; [1] • Less oxygen is pumped around the body; [1]		2
		•		

4	**a (i), (ii)**		[1] each	2
		• *Well answered.*		
	b	• (skin / receptor) → sensory neurone → relay neurone (in spinal cord); [1] • → motor neurone → arm muscle; [1]		2
		•		
5	**a**	A – anther / stamen [1] B – style [1] C – ovule [1] D – stigma [1]	[1] each	4
		•		
	b (i)	• insect visits not necessary, if no / few insect visits, self-pollination occurs / pollen from anther is transferred to stigma of the same flower; [1] • stigma able to bend and touch pollen on style / anther and stigma comes into contact; [1]		2
		• *Most did not make reference to the information from Fig. 5.1.*		
	b (iii)	• many visits likely to result in greater variation; ora [1] • more likely for cross-pollination / AW; [1] OR • little / no difference in variation; [1] • if insects transfer pollen within the same plant; [1]		2
		•		
6	**a**	• Genes are heredity factors found on a particular locus in a chromosome that controls a particular characteristic [1]; • Alleles are different forms of a gene that occupy the same relative positions on a pair of homologous chromosome [1]		2
		• *Most are still not sure of the terms.*		
	b	• labels; [1] • parent phenotype, parent genotype, alleles/gametes, offspring genotype, offspring phenotype		5

		• pure-breed guinea pig with smooth hair = rr + guinea pig offspring with rosette hair = Rr; [1] • correct offspring genotypes: 2 Rr and 2 rr; [1] • correct offspring phenotypes; [1] • Rr = rosette, rr = smooth • correct ratio (both genotype and phenotype); [1] • genotype ratio = Rr : rr = 1 : 1 • phenotype ratio = rosette : smooth = 1 : 1s		
		• *Well answered. Only 2 students gave the wrong genotype for parents.*		
	c (i)	• phenotype;		1
		•		
	c (ii)	1. change in gene structure / nucleotide sequence in the DNA; 2. transcription in nucleus produces an mRNA of a different sequence; 3. translation of mRNA in ribosome; 4. produces polypeptide with different amino acid sequence (resulting in a different protein produced, giving rise to less formation of hair);	Max: 3M [1] each	3
		• *Most unable to answer this question, unable to make the linkage between mutation, transcription and translation.*		
		•		
7	**a (i)**	• meiosis		1
		•		
	a (ii)	• ovule / anther / ovary		1
		•		
	a (iii)	• 1 E 2 C 3 D 4 F 5 A 6 B		1
		•		
	b	<table><tr><th></th><th>C / metaphase I</th><th>A / metaphase II</th></tr><tr><td>1.</td><td>Chromosomes are one either side of the equator.</td><td>Chromosomes are on the equator.</td></tr><tr><td>2.</td><td>Chromosomes are paired.</td><td>Chromosomes are not paired.</td></tr><tr><td>3.</td><td>Centromere are not on the equator.</td><td>Centromeres are on the equator.</td></tr></table>	Correct identification of stages A and C. [1] Any two marking points [2]	3

		•		
	c	• Crossing over occurs during prophase I. [1] • Random assortment occurs during metaphase I and II and anaphase I and II. [1]		2
		• *Brief answers without the stages of division were given.*		

Section B (30 marks)

Qn no.		Suggested answer	Comments to markers	Marks
8	a	 • appropriate scale used [1] • line of best fit [1] • correct label of axes [1] • points plotted correctly/ accurately [1]	Max [3]	3
		•		
	b	• 100 – 15= 85 arbitrary units [1]		1
		•		
	c	• As the wavelength of light increases from 420-500 nm, the sensitivity of the retina increases from 5 to 100 a.u. [1]. • From 500 to 600 nm, the sensitivity of the retina decreases from 100 to 5 a.u. [1]. • ***only award 1 mark if they give general trend and no data from the graph/table***		2
		•		

	d	• 42 ± 2 [1]	refer to graph for ECF	1
		•		
	e	• The change in wavelength is detected by the retina, which sends nerve impulses to the brain through the optic nerve [1]. • The brain then sends nerve impulses to the iris through the motor neuron [1]. • The circular muscles of the iris will contract, while the radial muscles relax [1] and this causes the pupil to constrict.		3
		• *Answers were incomplete and lacking in explanation of how the stimulus was received.*		
9	**a**	<table><tr><th>Suggestion:</th><th>Explanation:</th></tr><tr><td>Person may experience watery stool / diarrhoea ;</td><td>without absorption of water, egested material may still contain higher amount of water ;</td></tr><tr><td>Person may suffer from dehydration (initially after the surgery) ;</td><td>Colon functions to absorb water from undigested food back into the blood stream ;</td></tr></table>		3
		•		
	b	• Lock (enzyme) refers to the neuraminidase and key (substrate) refers to the glycoproteins on cell membrane; [1] • Enzymes (neuraminidase) are specific in nature binding only to one type of substrate (glycoproteins) at the active site; [1] • Once the enzyme binds to the substrate, to form the enzyme-substrate complex, it will be able to catalyse the breakdown of the substrate; [1] OR • When the cell membrane's structure is disrupted, the cell will lyse / break down; [1]		3
		• *Most did not mention which is the lock and which is the key.* • *Most left out the term "enzyme-substrate complex".*		
	c	• Relationship: When air temp increased, quantity of urine produced decreased; [1] • OR vice versa • Heat receptors in our skin are stimulated as temperature increases, negative feedback mechanism (homeostasis) sets in to regulate the internal body temperature ; [1] • Warmer temperature increased rate of sweating for removal of heat; [1] • More water lost via sweating means less excess water to be excreted in urine ; [1]		4

		• (Accept 1m for ref. to increased ADH secretion and water reabsorption at the nephron)		
		•		
10	**a**	2.5 – 4 + minutes for pulse (A any within range); 4 + minutes for breathing (A anything within range);		2
		•		
	b	muscles; For the remaining marks in this part, there must be the use somewhere of a word that indicates enhancement of at least one of the factors (i.e. more / greater, faster etc.). Thus, for example, 'more oxygen' scores, and so, then, would any ref. to CO2 removal or energy, even if 'more' is not repeated. more / faster blood transported to (muscles); [1] more oxygen / glucose + respiration; [1] ref. more CO_2 removed / lactic acid; [1] more energy (R produced, made, manufactured, etc.) for muscular contraction; [1]		4
		•		
	c	(max 2m if students never indicate who they are talking about) *student F is fitter / exercises regularly AW; *more efficient muscles / better breakdown of lactic acid; *more efficient circulation / no or limited cholesterol in blood vessels; *more efficient lungs / respiratory system; *exercised less vigorously; *more haemoglobin / more RBCs; (*A reverse arguments for Student E) student E was a smoker, F was not; student E was obese / overweight AW (R large mass); emphysema; (b) suffered from asthma / bronchitis / heart problems / lung infection AW;		4
		•		

- END OF PAPER -