Candidate Name:	Class:	Index No.:

FUHUA SECONDARY SCHOOL
Secondary Four Express
PRELIMINARY EXAMINATION 2025

4E

Biology **6093/01**
Paper 1

Additional Materials: *OMR Sheet*

DATE **3 September 2025**

TIME **1000 – 1100**
DURATION **1 hour**

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 OMR and this question booklet.

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 OMR provided.

Read the instructions on the OMR 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

FOR EXAMINER'S USE	PARENT'S SIGNATURE

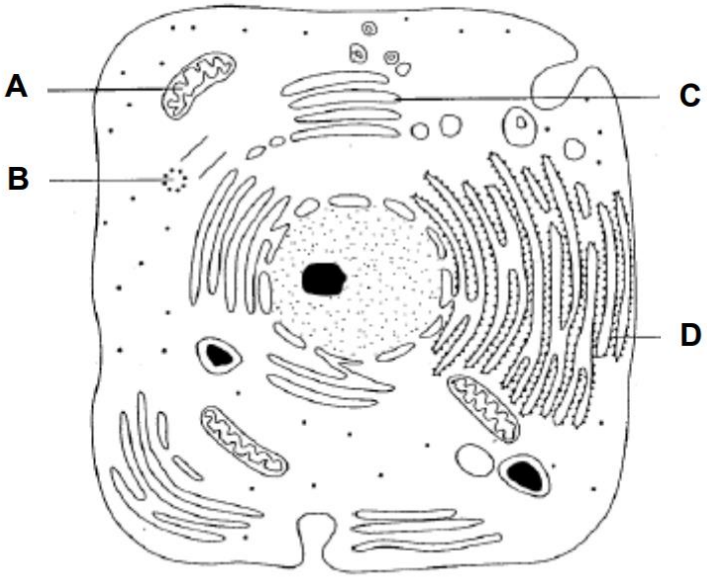
Setter: **Ms Germain Kang** **Vetter:** **Mr Nicholas Liu**

This document consists of 18 printed pages and 2 blank pages.

Multiple-Choice Questions [40 marks]
Shade your answers on the OMR sheet provided.

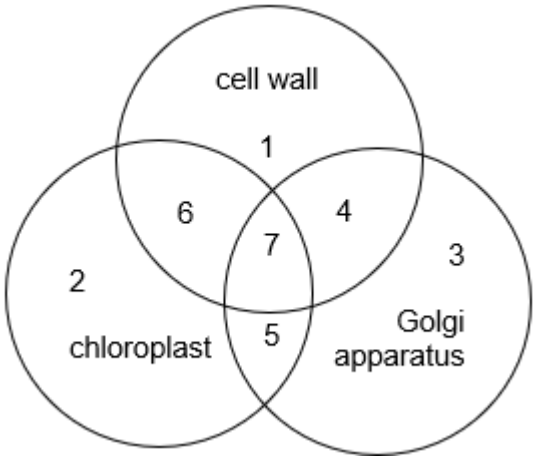
1 The diagram below shows the structure of an animal cell.

In which cell organelle is glucagon modified before secretion out of the cell?



2 The diagram refers to some structures found in cells.

Which area in the diagram represents root hair cell and xylem respectively?

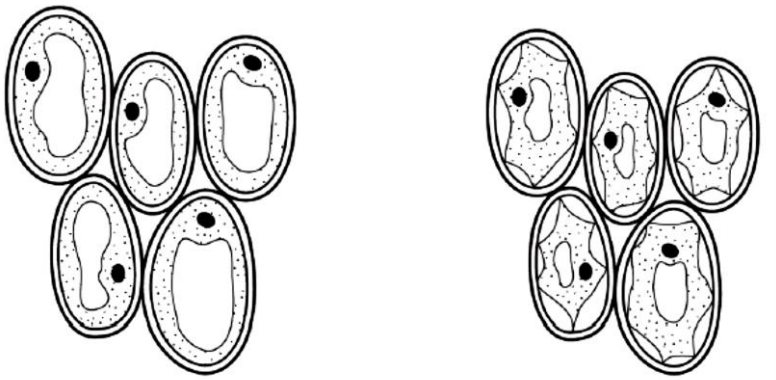


	root hair cell	xylem
A	4	1
B	5	2
C	6	3
D	7	7

3 Which correctly identifies the processes involved in the absorption of these substances in a healthy kidney nephron?

	glucose	urea	water
A	diffusion	osmosis	active transport
B	osmosis	diffusion	dialysis
C	active transport	diffusion	osmosis
D	active transport	osmosis	diffusion

4 The diagrams below show plant cells before and after being placed in sugar solution.



before after

Which of the following explains the change?

	reason	process	sugar solution
A	sugar molecules enter the cells	active transport	dilute
B	sugar molecules exit the cells	active transport	concentrated
C	water molecules enter the cells	osmosis	dilute
D	water molecules exit the cells	osmosis	concentrated

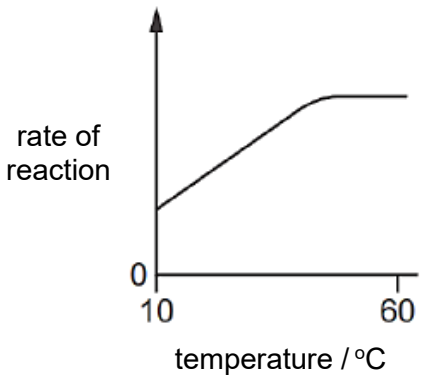
5 Which element from a molecule of urea shows that it is formed from amino acids and not from glucose?

A carbon
B hydrogen
C nitrogen
D oxygen

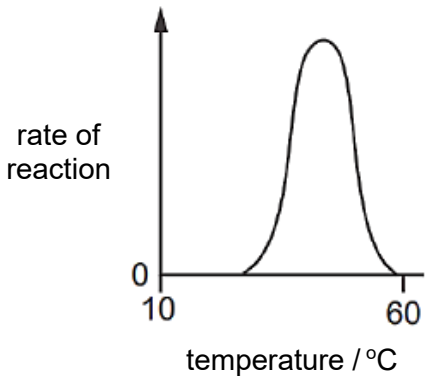
6 An enzyme extracted from a bacteria living in hot springs is known to have an optimum temperature between 90 °C to 95 °C.

Which of the following represents the rate of reaction of this enzyme against temperature?

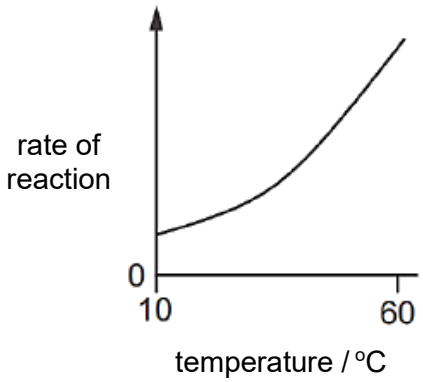
A



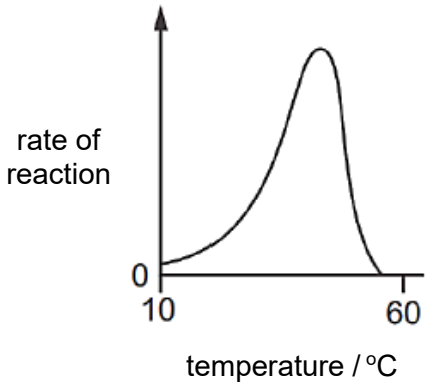
B



C



D



7 The table below shows the results of experiments performed at 37 °C.

test tube	substances added to test tube	food tests carried out 20 minutes after start of experiment	
		iodine test	Benedict's test
1	5 ml of Y + 3 ml of water	blue black	blue
2	5 ml of Y + 2 ml of Z + 1 ml of HCl	blue black	blue
3	5 ml of Y + 2 ml of Z + 1 ml of NaOH	brown	brick red
4	5 ml of Y + 2 ml of boiled Z + 1 ml of water	blue black	blue

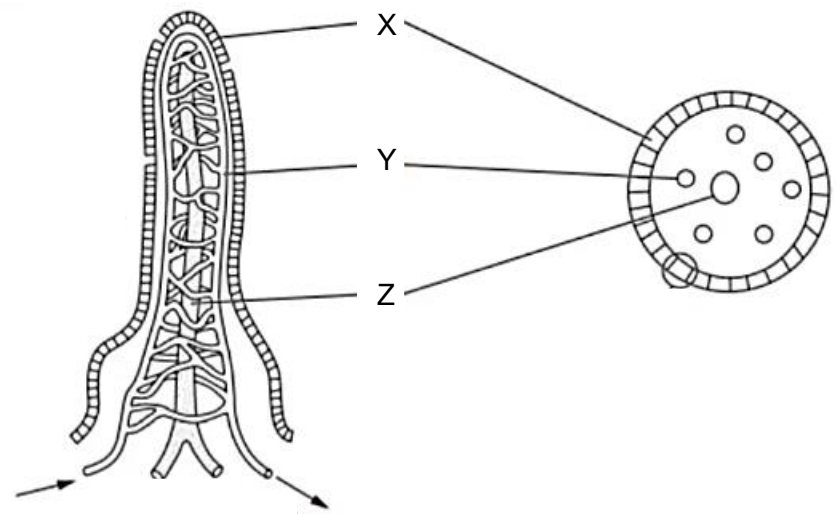
Which of the following correctly states the identity of Y, Z and product of the reaction?

	Y	Z	product of the reaction
A	glycogen	saliva	non-reducing sugar
B	glycogen	saliva	reducing sugar
C	starch	gastric juice	reducing sugar
D	starch	pancreatic juice	reducing sugar

8 Which process can still be carried out in a patient with liver failure?

A breakdown of alcohol
B conversion of glucose to glycogen
C metabolism of amino acids to urea
D production of trypsin

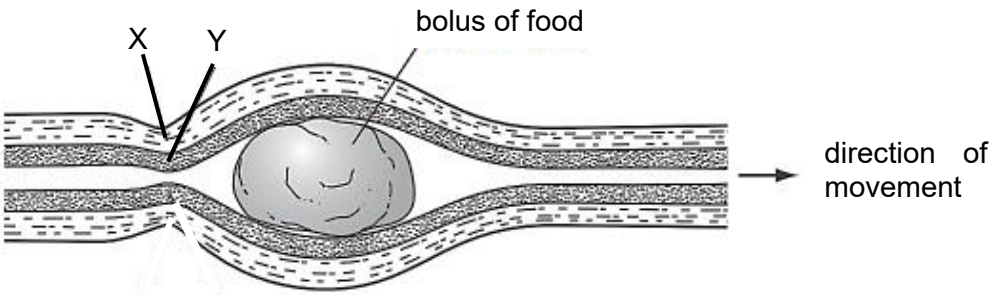
9 The diagram shows an intestinal villus and its cross section.



Which nutrient is absorbed by structure Z?

A amino acids
B fats
C glucose
D glycogen

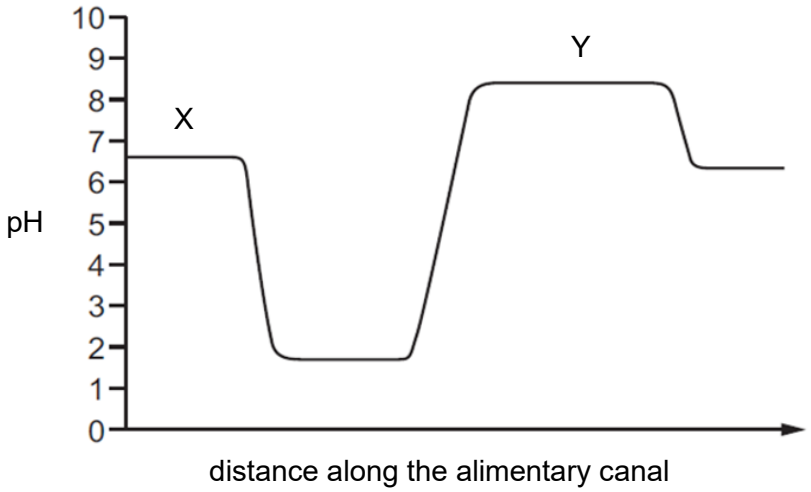
10 The diagram shows a bolus of food moving along the oesophagus.



Which row describes the condition of the muscles at X and Y?

	X	Y
A	contracted	contracted
B	contracted	relaxed
C	relaxed	contracted
D	relaxed	relaxed

11 The graph below shows how pH changes along the alimentary canal.



Which correctly identifies the enzymes that can be found in region X and Y?

	X	Y
A	amylase	lipase
B	maltase	trypsin
C	pepsin	amylase
D	trypsin	pepsin

12 Which is the pulmonary vein?

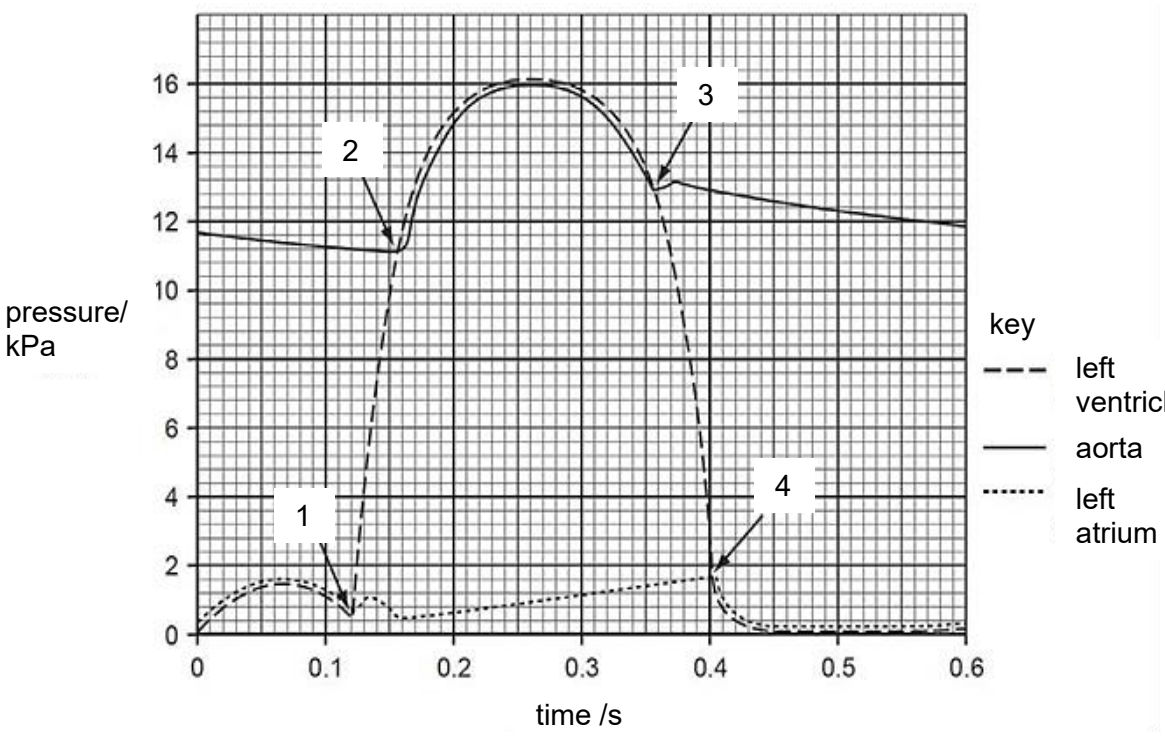
	feature			
	blood	direction of blood flow	lumen	muscle layer
A	deoxygenated	away from the heart	narrow	thick
B	deoxygenated	towards the heart	wide	thin
C	oxygenated	away from the heart	narrow	thick
D	oxygenated	towards the heart	wide	thin

13 What is the sequence of the steps for blood clotting?

1 thrombin converts fibrinogen into fibrin
2 thrombokinase is produced by damaged platelets
3 thrombokinase comes into contact with calcium ions
4 thrombokinase activates prothrombin into thrombin

A 1→ 2 → 3 → 4
B 1 → 2 → 4 → 3
C 2 → 3 → 4 → 1
D 2 → 4 → 3 → 1

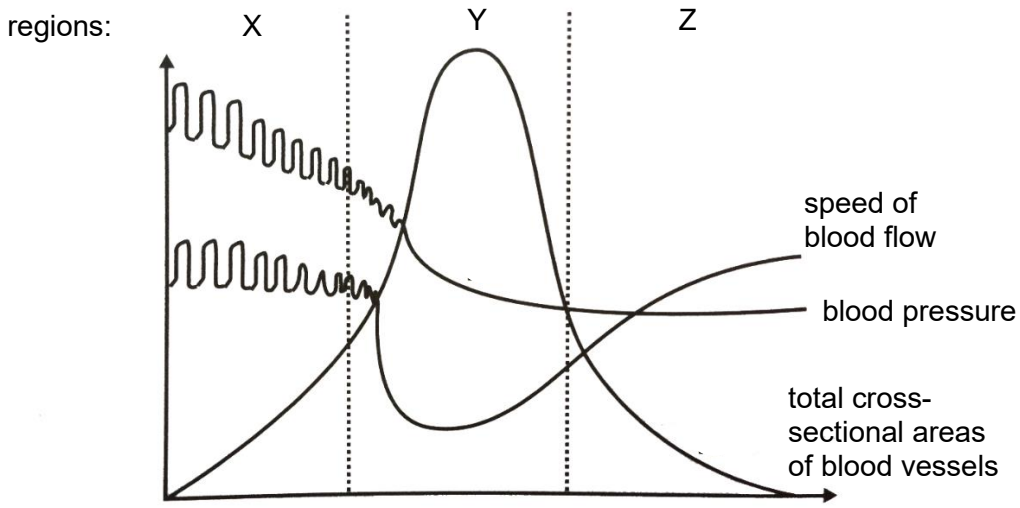
14 The graph shows the pressure changes in the aorta and the left side of the heart during one cardiac cycle. Points 1, 2, 3 and 4 indicate when atrio-ventricular valves and semi-lunar valves either open or close.



What is the total time during one cardiac cycle that the atrio-ventricular valves and the semi-lunar valves are both closed at the same time?

A 0.03 s
B 0.07 s
C 0.12 s
D 0.25 s

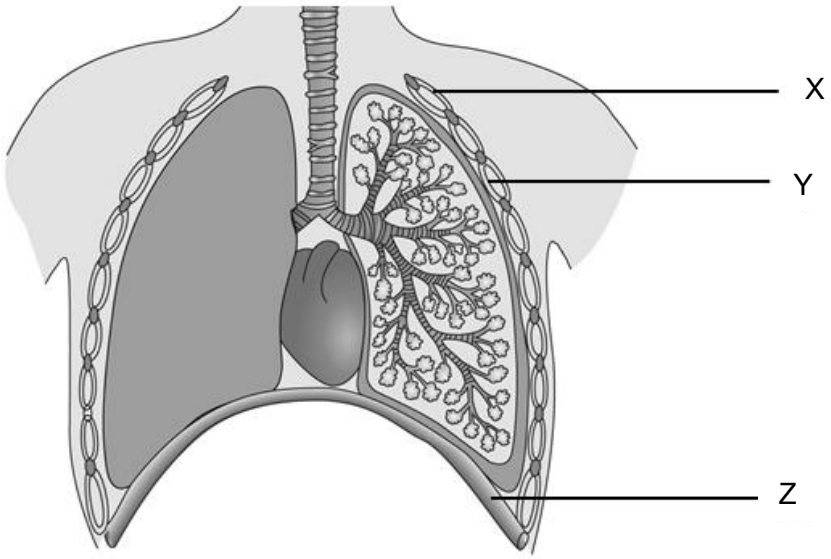
15 The diagram below shows the characteristics of three types of blood vessels.



Which of the following correctly identifies regions X, Y and Z?

	X	Y	Z
A	arteries	capillaries	veins
B	arteries	veins	capillaries
C	capillaries	arteries	veins
D	veins	capillaries	arteries

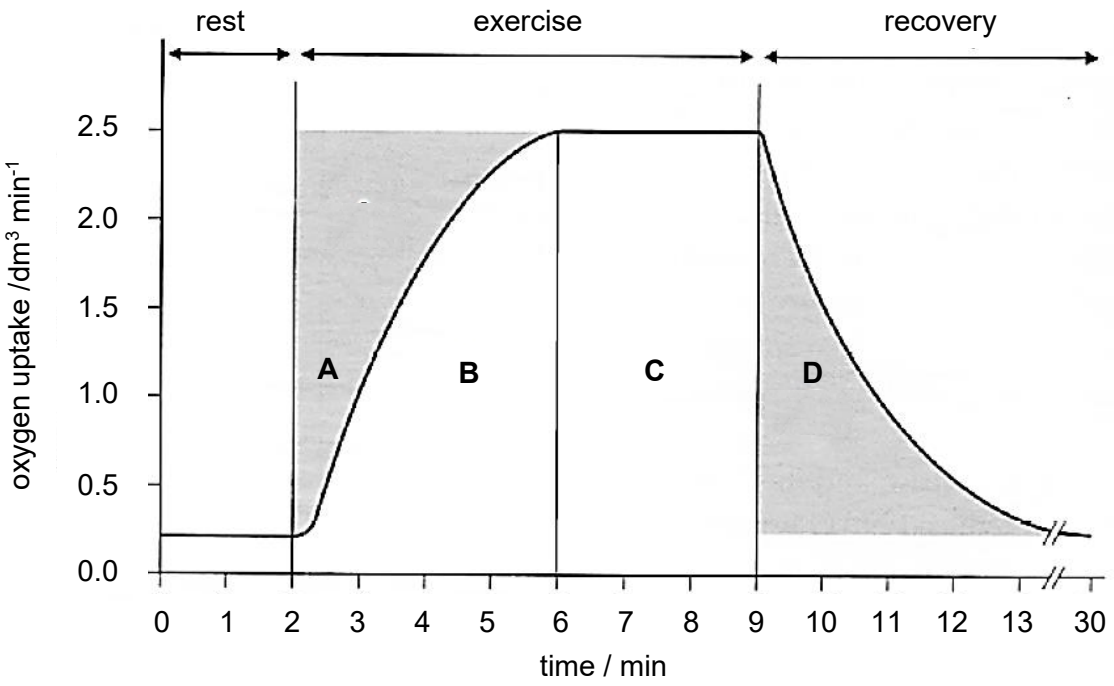
16 The diagram below shows the longitudinal section of the human thorax.
Structures X, Y and Z are different sets of muscles.



What occurs so that inhalation can take place?

	X	Y	Z
A	contract	relax	contract
B	contract	relax	relax
C	relax	contract	contract
D	relax	contract	relax

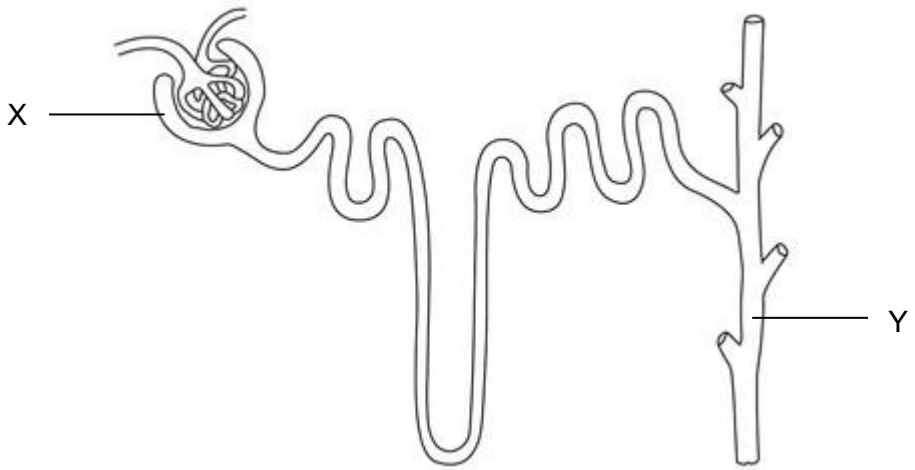
17 The diagram shows the oxygen uptake of a man before, during and after strenuous exercise.
Which region represents the repayment of oxygen debt?



18 In the kidney dialysis machine, protein molecules are not lost from the blood.
How is the loss prevented?

A Dialysis fluid contains protein molecules to prevent a steep concentration gradient.
B Protein molecules are actively transported back into the blood.
C Protein molecules are too large to diffuse across the dialysis membrane and out of the blood.
D Protein molecules in the blood and the dialysis fluid diffuse to reach an equilibrium.

19 The diagram shows the simplified structure of a kidney nephron.



The table shows the quantities of three substances 1, 2 and 3 as they pass through parts X and Y of the nephron.

substance	quantity passing through X / g	quantity passing through Y / g
1	180	1.5
2	60	55
3	200	0

Based on the data, what are the identities of substances 1, 2 and 3 in a healthy individual?

	substance 1	substance 2	substance 3
A	amino acids	water	glucose
B	glucose	urea	water
C	water	sodium ions	urea
D	water	urea	glucose

20 Which factors are controlled by homeostasis?

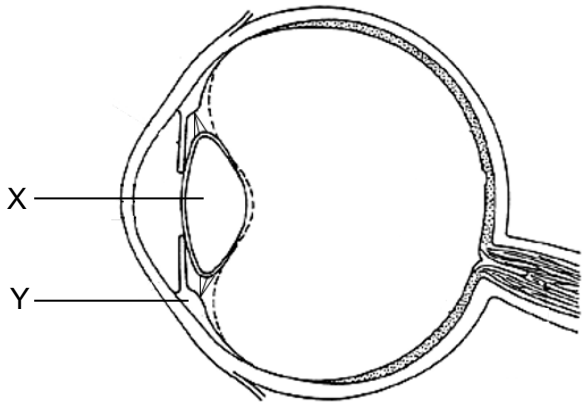
	water content in the ileum	water content in the urine	temperature in the liver
A	✓	✓	✗
B	✓	✗	✗
C	✗	✓	✓
D	✗	✗	✓

key

✓= controlled by homeostasis

✗ = not controlled by homeostasis

21 The diagram below shows the cross section of the human eye.

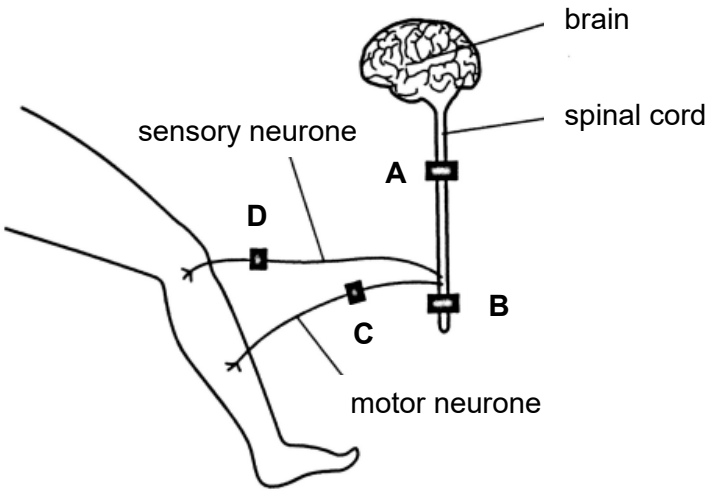


What happens to structure X and Y as the eye focuses on a near object?

	structure X	structure Y
A	becomes less convex	contracts
B	becomes less convex	relaxes
C	becomes more convex	contracts
D	becomes more convex	relaxes

22 This diagram of the nervous system shows four places, **A**, **B**, **C**, and **D**, where a local anaesthetic block can be applied. The block prevents nerve impulses from travelling along neurones.
A patient had an anaesthetic block applied at one of the sites shown, **A**, **B**, **C**, or **D**. He cannot feel a pinprick on his leg but can move his leg.

Where was the anaesthetic block applied?



23 Which shows the correct pathogen, transmission mode and treatment method for Pneumococcal disease?

	pathogen	transmission mode	treatment method
A	bacterium	droplets	antibiotics
B	bacterium	insect bite	vaccination
C	virus	shared needles	antibiotics
D	virus	droplets	vaccination

24 Children in Singapore are provided with vaccination against deadly infectious diseases such as Tuberculosis, Hepatitis B, Poliovirus and Pneumococcal disease.

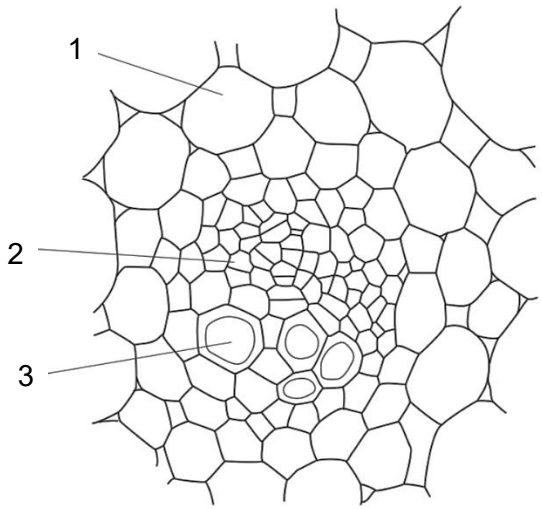
How do these vaccinated individuals help provide protection to those who are not vaccinated?

A They allow for the stimulation of white blood cells to quickly produce antibodies.
B They allow pathogens infecting unvaccinated individuals to be in milder forms.
C They ensure pathogens do not mutate and become resistant to the vaccines.
D They reduce the chances when pathogens may be present and can spread.

25 Which external factor, when decreased, will cause an increase in water movement through the xylem vessels to the surrounding atmosphere?

A humidity
B light intensity
C temperature
D wind

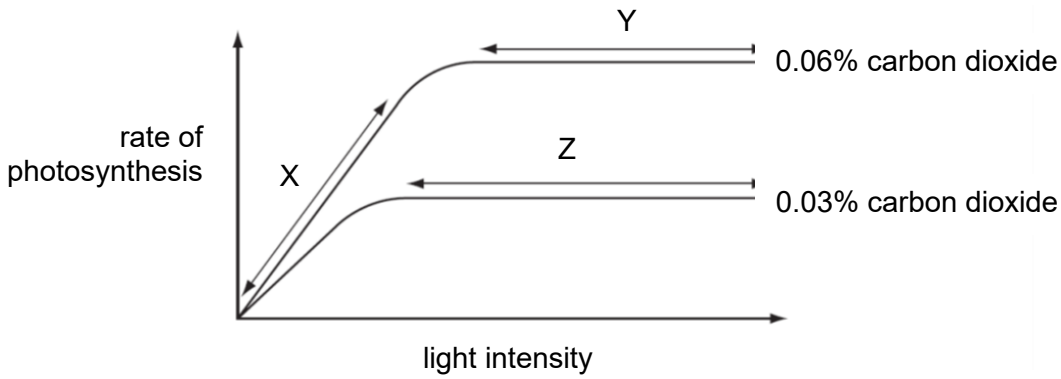
26 The diagram shows a vascular bundle from the stem of a plant.



Which row describes the functions of the labelled cells?

	transports sucrose	transports dissolved ions
A	1	2
B	2	1
C	2	3
D	3	1

27 The graph shows the rate of photosynthesis of a plant at increasing light intensities at two different carbon dioxide concentrations. The temperature is kept constant.



What are the limiting factors of the rate of photosynthesis at X, Y and Z?

	X	Y	Z
A	carbon dioxide	light intensity	carbon dioxide
B	carbon dioxide	light intensity	light intensity
C	light intensity	carbon dioxide	carbon dioxide
D	light intensity	carbon dioxide	light intensity

28 Which statement about carbon sinks is correct?

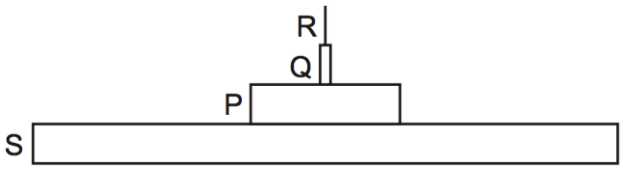
A All carbon sinks are fossil fuels.
B Carbon sinks remove carbon dioxide permanently from the atmosphere.
C Carbon sinks emit more carbon dioxide than they absorb.
D The oceans are important carbon sinks.

29 The table shows the results of a field study of four species in a food chain in an area of woodland.

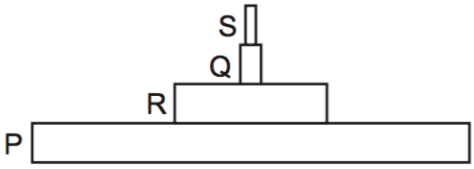
species	number of individuals	biomass of one individual / arbitrary units	energy value per unit mass / arbitrary units
P	10 000	0.100	1.0
Q	5	10.000	2.0
R	500	0.002	1.8
S	3	300 000.000	0.5

Which is the correct pyramid of biomass from these data?

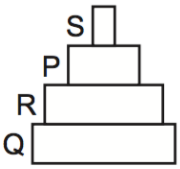
A



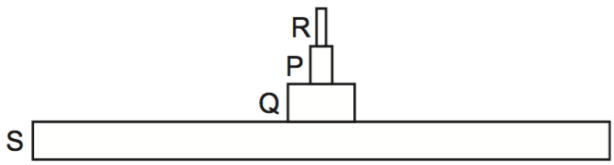
B



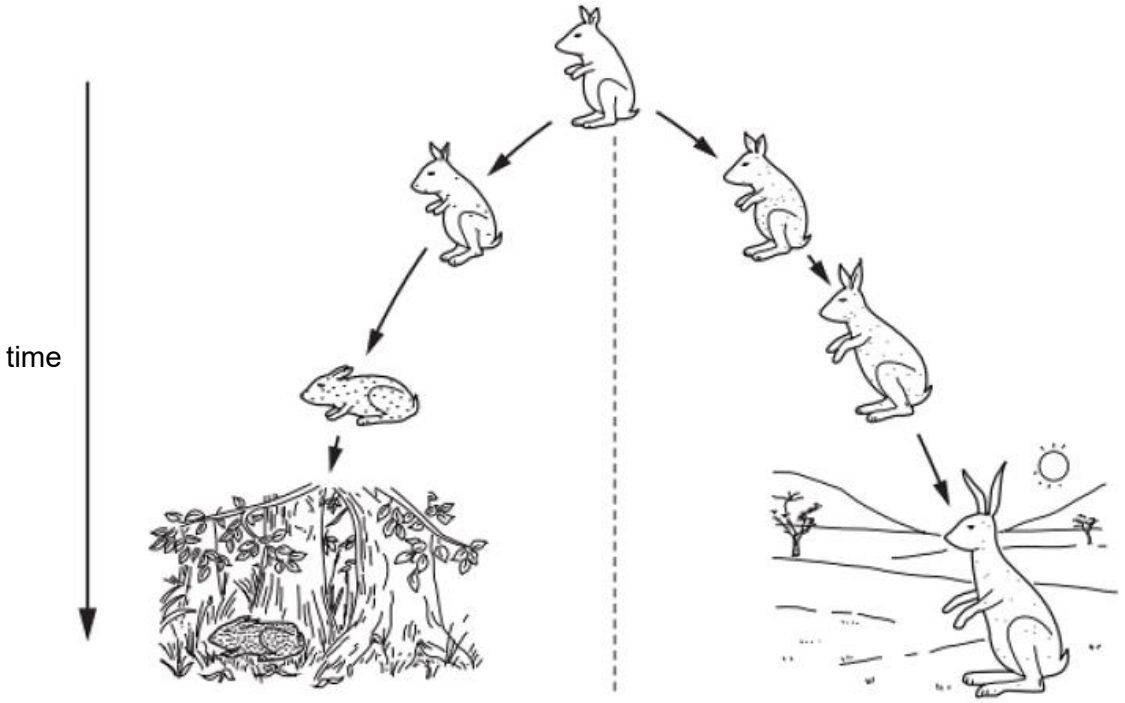
C



D



30 The diagram shows a species changing to survive in two different habitats.



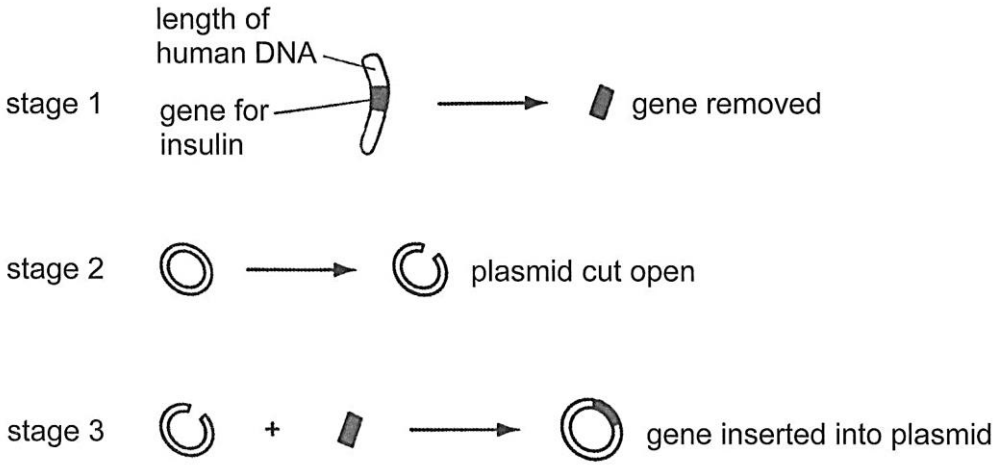
Which statement best explains this change?

A Desirable genes were inherited by offsprings.
B Individuals that survived in each habitat passed down their survival skills to the next generation.
C The competition among the population forced the species to colonise two distinct habitats.
D The species evolved by adapting quickly to the different habitats.

31 DNA consist of two strands in which _____

A the percentage of cytosine is the same in each strand.
B the percentage of cytosine is the same as that of guanine in each strand.
C the percentage of cytosine is the same as that of guanine in the whole molecule.
D the percentage of cytosine is 50% of that of guanine in the whole molecule.

32 A human insulin gene can be cut out of the human DNA and inserted into the plasmid of a bacterium. The diagrams below show three stages of this process.



Which row correctly identifies the enzymes in each stage?

	name of enzyme in		
	stage 1	stage 2	stage 3
A	restriction enzyme X	restriction enzyme Y	DNA ligase
B	restriction enzyme X	restriction enzyme X	DNA ligase
C	restriction enzyme Y	restriction enzyme X	*Hae* III
D	restriction enzyme Y	restriction enzyme Y	*Hae* III

33 The diagram shows part of the sequence of nucleotides in a gene.

T – A – G – C – G – A – T – G – G

Which represents the complementary mRNA strand?

A A – T – C – G – C – T – A – C – G
B U – A – C – G – C – U – A – C – C
C A – U – C – G – C – U – A – C – C
D T – A – G – C – G – A – T – G – C

34 Small pieces of the stem were taken from an orchid plant and placed in a nutrient medium. Each piece of the stem produced a new orchid plant.

Which type of reproduction is shown in this example and how do the genotypes of the new plants compare to the genotype of the parent plant?

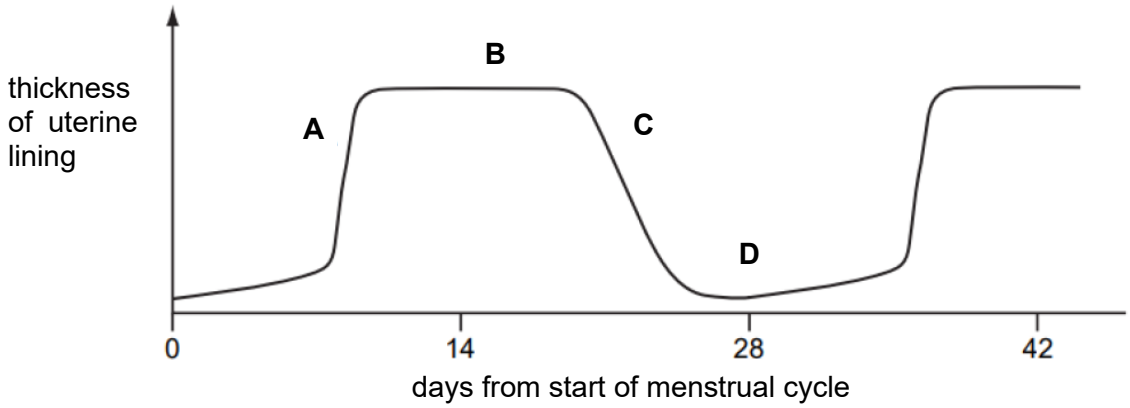
	type of reproduction	genotype
A	asexual	dissimilar
B	asexual	identical
C	sexual	dissimilar
D	sexual	identical

35 Which row shows the effects of oestrogen and progesterone?

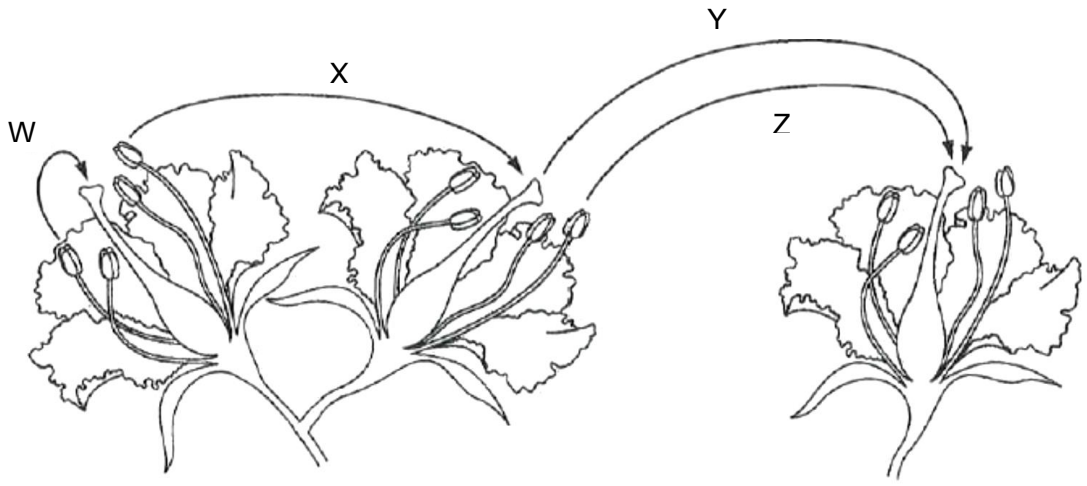
	high level needed for ovulation	high level needed to stop development of more ova	maintains the uterus lining	repairs the uterus lining
A	oestrogen	progesterone	oestrogen	progesterone
B	oestrogen	progesterone	progesterone	oestrogen
C	progesterone	oestrogen	oestrogen	progesterone
D	progesterone	oestrogen	progesterone	oestrogen

36 The diagram shows the changes in thickness of the uterine lining of a woman during her menstrual cycle.

At which point is the woman most likely to be fertile?



37 The diagram shows two plants of the same species.



Which arrow(s) indicate(s) a process that would lead to the following outcomes?

	sexual reproduction	greater adaptability of the plant species to changing environmental conditions
A	X only	X and Z only
B	W, X and Z only	W and X only
C	W, X and Z only	Z only
D	W, X, Y and Z	X and Z only

38 Which of the following is an example of continuous variation within a group of humans?

A ability to roll their tongues
B blood groups
C gender
D skin tone

39 In a species of plant, the colour of its flowers is controlled by one gene. The colours are observed to be purple or white.

In an experiment to investigate the inheritance of flower colour in this plant species, four genetic crosses were carried out, producing 40 offspring in each cross. The phenotypes of the parents and offspring are recorded in the table below.

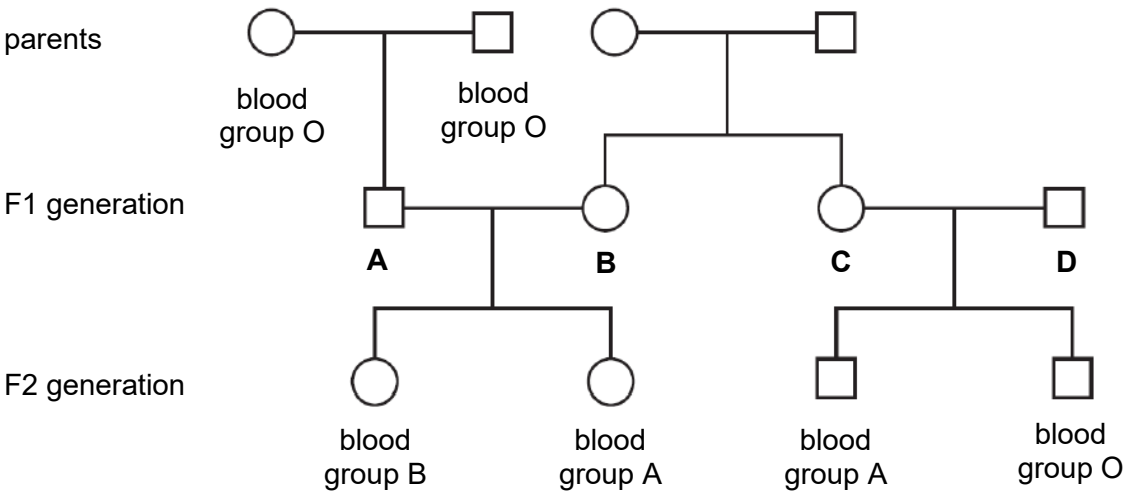
cross	parent 1	parent 2	number of offspring of each phenotype
1	purple	white	40 purple
2	purple	purple	31 purple, 9 white
3	white	white	40 white
4	purple	white	21 purple, 19 white

Which of the following can be concluded based on the above information?

A One parent in cross 2 will be heterozygous and the other will be homozygous.
B Both parents in cross 1 are homozygous.
C Parent with purple flowers in cross 1 will have the same genotype as parent with purple flowers in cross 4.
D Two parents in cross 3 will have different genotypes.

40 The diagram shows the blood group phenotypes of the members of a family.

Which member of the F1 generation must be heterozygous, with codominant alleles?



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Answer Key

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