Name:	Index Number:	Class:

YIO CHU KANG SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2024
SECONDARY FOUR EXPRESS

BIOLOGY
Paper 1

6093/01
1 hour

Additional Materials:
Optical Answer Sheet (OAS)

9 September 2024 (Monday)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil on the OAS.
Do not use staples, paper clips, glue or correction fluid.
Write your name, index number and class on the OAS 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 OAS.
Read the instructions on the OAS 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 question paper.
The use of an approved scientific calculator is expected, where appropriate.

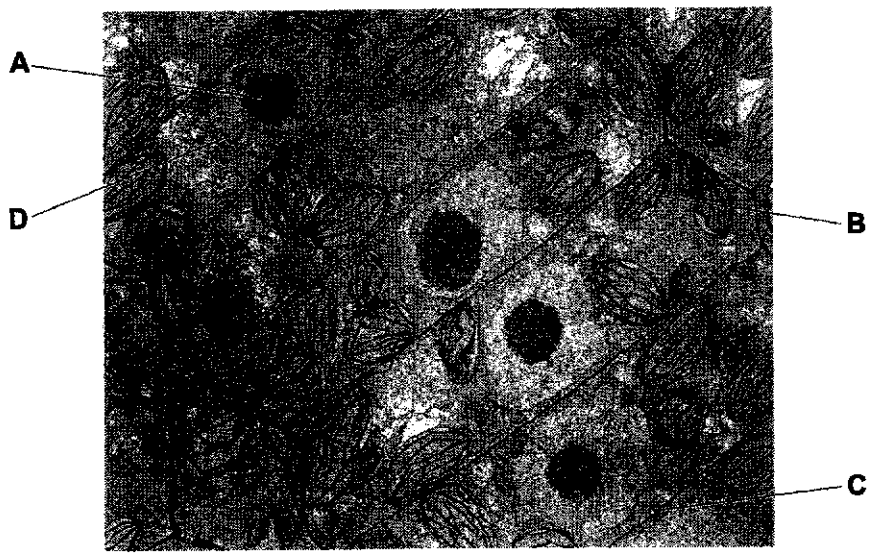
For Examiner's Use
40

This document consists of **20** printed pages.

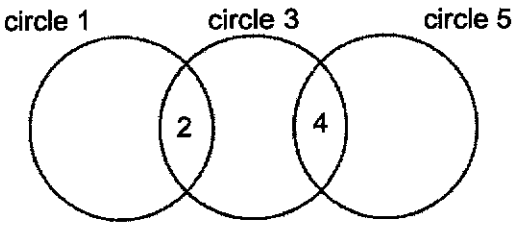
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1 The electron micrograph shows some cells from a plant.

Which cell structure is not usually found in cells from a root?



2 The diagram shows three circles, 1, 3 and 5, and the shared structures, 2 and 4.



Which row correctly identifies the three circles and some of the structures that are shared between them?

	circle 1	2	circle 3	4	circle 5
A	muscle cell	no nucleus	red blood cell	mitochondria	xylem vessel
B	muscle cell	cytoplasm	xylem vessel	cell membrane	red blood cell
C	red blood cell	cell membrane	muscle cell	chloroplast	xylem vessel
D	xylem vessel	no nucleus	red blood cell	cell membrane	muscle cell

3 What happens to the surface area to volume ratio of a cube when the length of each side is doubled?

A The ratio decreases by four times.

B The ratio halves.

C The ratio doubles.

D The ratio increases by four times.

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4 Which row identifies how ions and molecules move by active transport?

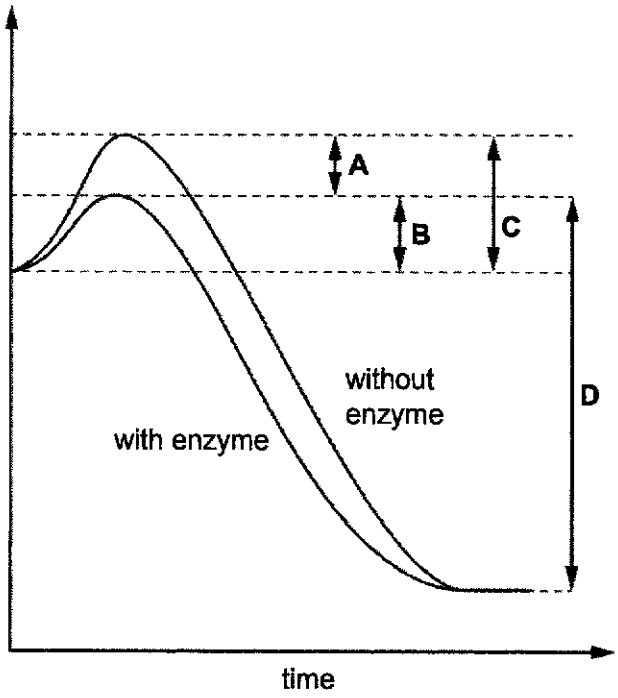
	against concentration gradient	down concentration gradient	through a membrane	requiring energy
A	✓	×	✓	✓
B	✓	×	✓	×
C	×	✓	×	×
D	×	✓	✓	✓

5 Some health problems can be detected using chemical tests for protein and glucose in the urine.

Which row shows the results for a person with protein and glucose in their urine?

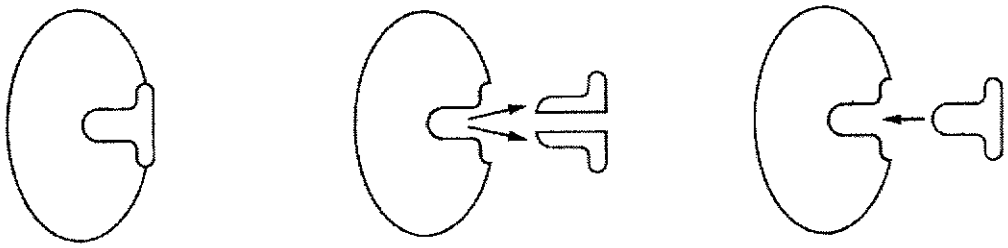
	Benedict's solution	biuret reagent	ethanol	iodine solution
A	blue	blue	white emulsion	brown
B	blue	violet	colourless	blue-black
C	red	blue	white emulsion	blue-black
D	red	violet	colourless	brown

6 Which region on the graph shows the activation energy of an enzyme-catalysed reaction?



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7 These diagrams show the interaction between an enzyme molecule and a substrate molecule. The diagrams were listed by number.



event 1 event 2 event 3

Four students were asked to match the descriptions to the diagrams. The descriptions were listed by letter.

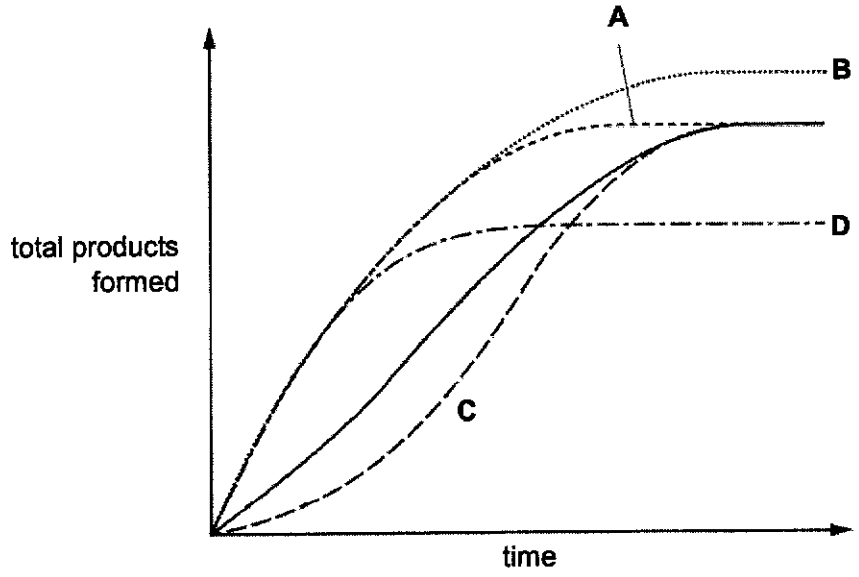
V A chemical reaction occurred, and the substrate is broken down into its products.
W Active site of enzyme is unoccupied, and substrate can fit in.
X An enzyme-substrate complex is formed.
Y Enzyme remained chemically unchanged at the end of the reaction.
Z Only substrates complementary to the active site of the enzyme can fit in.

Which student correctly matched the event to the descriptions to the diagram?

	event 1	event 2	event 3
A	V	W and Z	X and Y
B	W	X and Y	V and Z
C	X	V and Y	W and Z
D	Z	V and W	X and Y

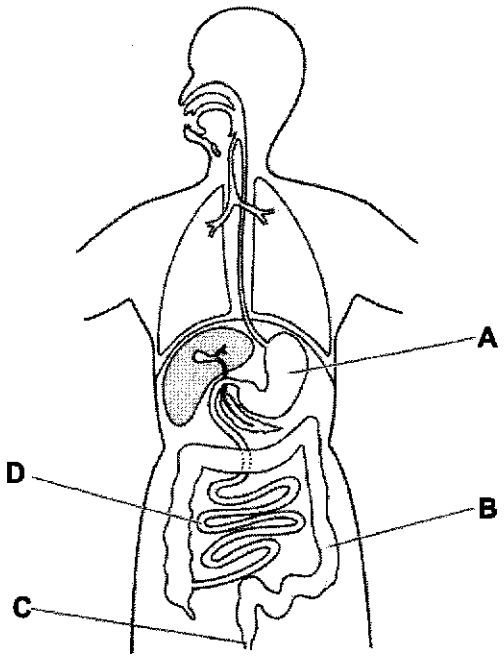
8 The solid line on the graph represents the amount of products formed over time for a reaction in a cell.

Which other line represents the effect of adding the enzyme for this reaction?

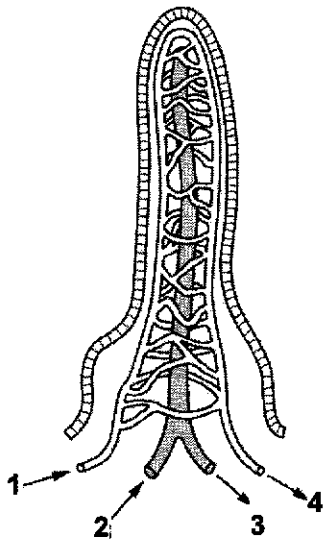


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9 The diagram shows the digestive system. Which part absorbs the most water?



10 The diagram shows a villus. The arrows show the direction of flow within vessels associated with the villus.



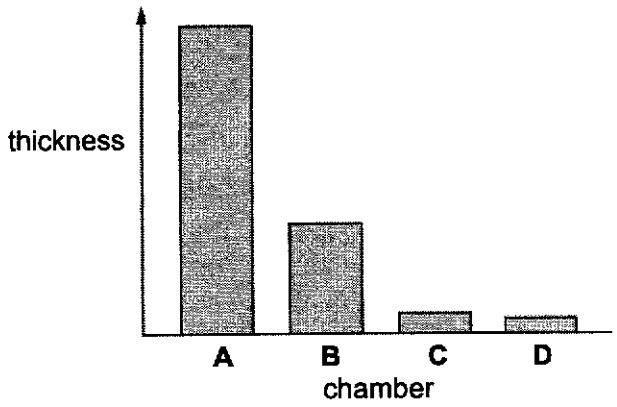
Which of the following correctly compared the concentration of substances transported in the vessels?

	concentration of glucose	concentration of amino acids	concentration of fats
A	highest in 2 and 3	highest in 1	lowest in 1 and 4
B	highest in 4	lowest in 1	highest in 2
C	lowest in 1	highest in 2	lowest in 2
D	lowest in 2 and 3	highest in 4	highest in 3

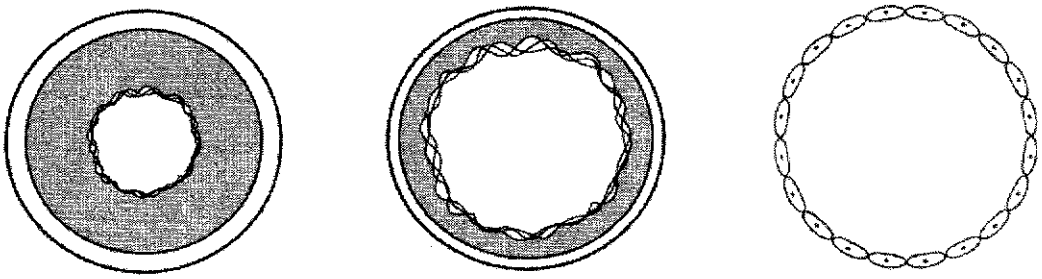
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11 The graph shows the thickness of the muscular wall in each of the four chambers of the mammalian heart.

Which chamber is the right ventricle?



12 The diagrams show sections through three types of blood vessel. They are not drawn to the same scale.

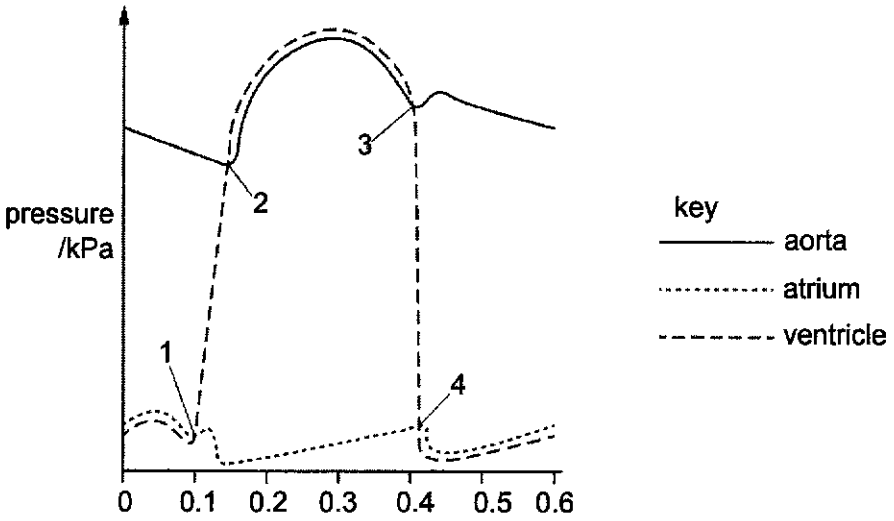


Which of the following descriptions best represents the blood vessels?

	blood vessel 1	blood vessel 2	blood vessel 3
A	allows exchange of substances	most contains valves	can undergo vasodilation
B	can undergo vasodilation	allows exchange of substances	most contains valves
C	can withstand high blood pressure	most contains valves	allows exchange of substances
D	most contains valves	can undergo vasodilation	allows exchange of substances

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13 The diagram gives information about blood pressure in the left side of the heart during the cardiac cycle.



Valves open and close at the points numbered.

Which row identifies the valves opening or closing at the points numbered?

	bicuspid valve opens	semilunar valve open	bicuspid valve close	semilunar valve close
A	1	3	4	2
B	2	4	3	1
C	3	1	2	4
D	4	2	1	3

14 During inspiration, the processes listed take place.

P volume of the thorax increases
Q air rushes into the lungs
R pressure in the thorax decreases
S external intercostal muscles contract
T diaphragm moves down, ribs move upwards and outwards

What is the correct sequence for these processes?

A Q → P → S → R → T

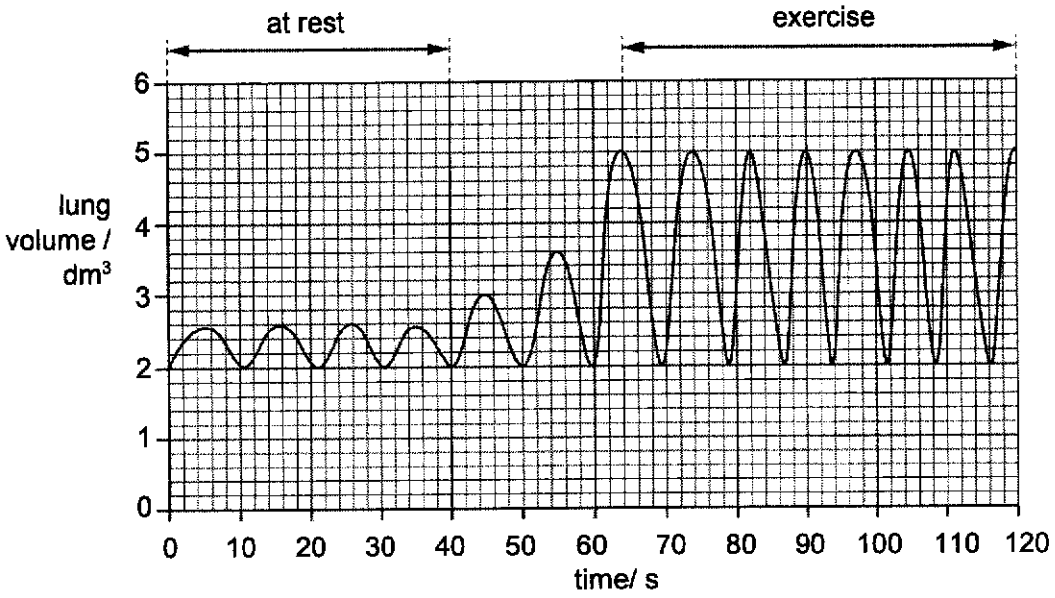
B S → T → P → R → Q

C Q → P → S → T → R

D S → Q → R → P → T

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15 The graph shows the changes in lung volume during breathing when a person was at rest and then when they began to exercise.



From resting to exercise, the volume of air breathed in at each breath increased from .....x..... dm^3 to .....y..... dm^3.

Looking at the graph, which numbers correctly complete the gaps in the sentence?

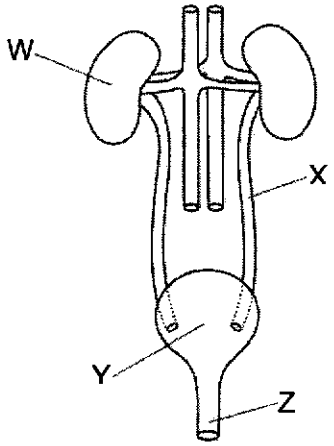
	x	y
A	0.5	3.0
B	0.5	5.0
C	2.0	5.0
D	5.0	2.0

16 Which row shows where glucose will be found in the body of a healthy human after eating a meal?

	renal artery	renal vein	glomerulus	nephron	ureter
A	no	yes	no	no	yes
B	yes	no	yes	yes	yes
C	yes	yes	no	no	no
D	yes	yes	yes	yes	no

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17 The diagram shows parts of the body involved in excretion in humans.

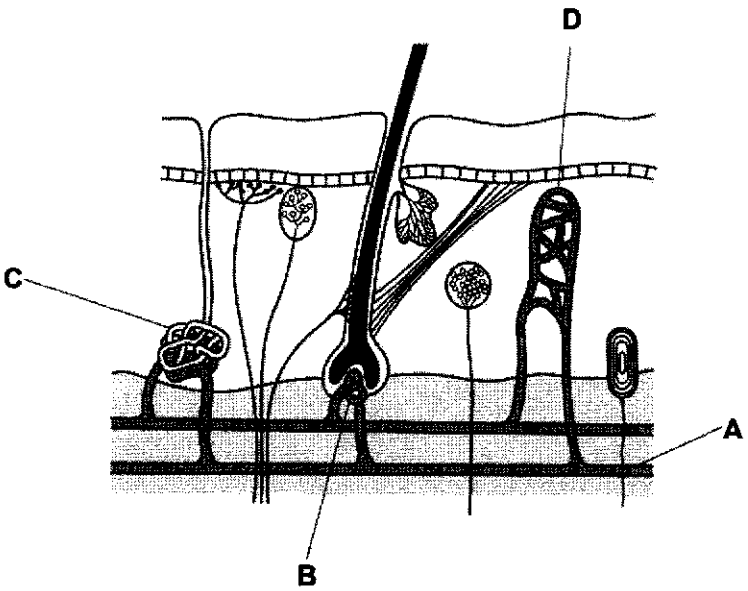


What are the labelled parts?

	W	X	Y	Z
A	bladder	ureter	kidney	urethra
B	bladder	urethra	kidney	ureter
C	kidney	ureter	bladder	urethra
D	kidney	urethra	bladder	ureter

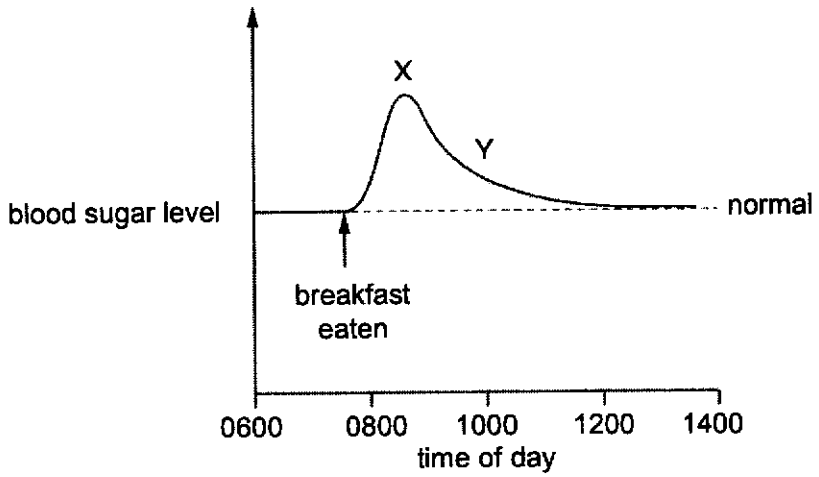
18 The diagram shows the structure of the human skin.

Which structure constricts to reduce heat loss?



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19 The graph shows the blood sugar level for a person over eight hours. He did not exercise during this time.



Which statement explains the shape of the graph between X and Y?

A The pancreas produces glucagon which causes excess sugar in the blood to be converted to glycogen.

B The liver produces insulin which causes excess sugar in the blood to be converted to glycogen.

C The pancreas produces insulin which causes excess sugar in the blood to be converted to glycogen.

D The liver produces glucagon which causes excess sugar in the blood to be converted to glycogen.

20 Descriptions of the body's response to changes in temperature are listed.

1 Hair erector muscles contract.
2 Hair erector muscles relax.
3 Sweat evaporates from the skin.
4 Muscles contract spontaneously.

Which descriptions occur when the body loses heat?

A 1 and 3

B 1 and 4

C 2 and 3

D 2 and 4

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21 A student was asked to compare a typical spinal reflex action with a voluntary action.

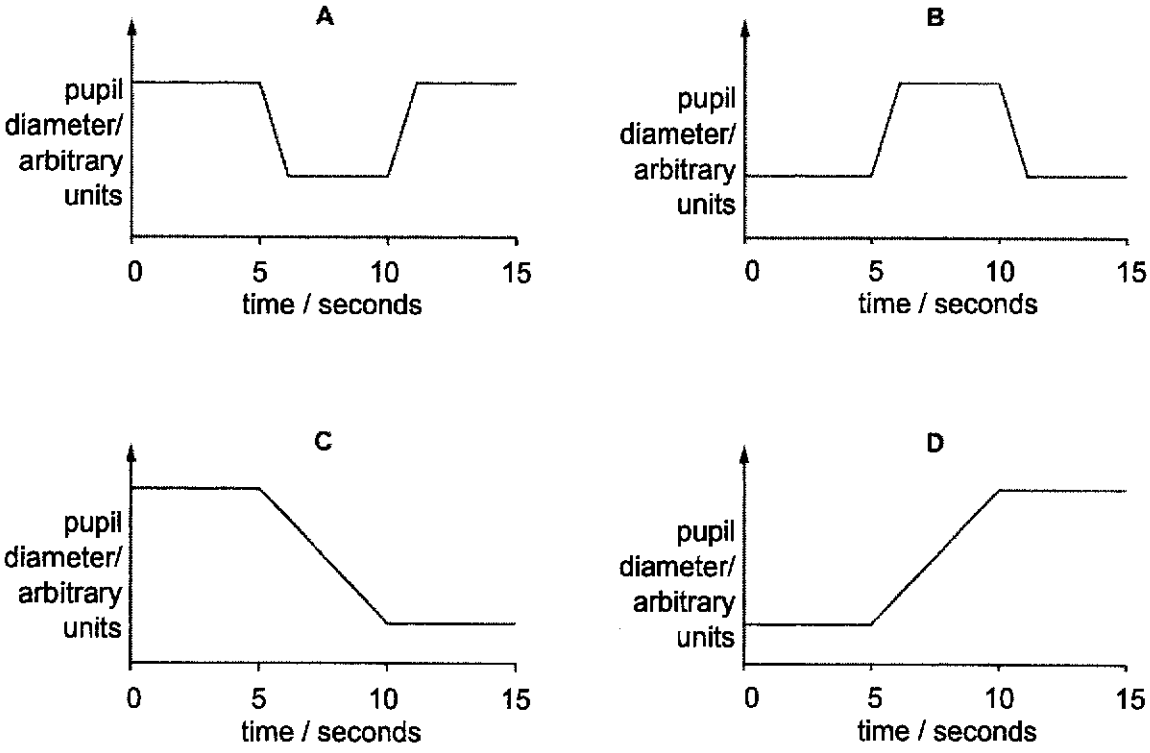
He has made one mistake in his comparison.

Which row shows the incorrect statement?

	reflex action	voluntary action
A	rapid response to a stimulus	response may be slow
B	initiated by the response of a receptor to a stimulus	initiated from the brain by conscious thought
C	the nervous impulse takes the longest pathway	the nervous impulse takes the shortest pathway
D	effectors are muscles or glands	effectors are muscles only

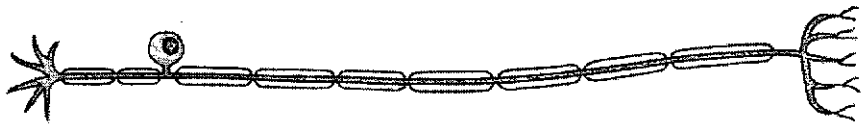
22 A person is sitting in a darkened room. After five seconds, a light is turned on. Five seconds after that, the light is turned off again.

Which graph shows the changes in the diameters of their pupils?

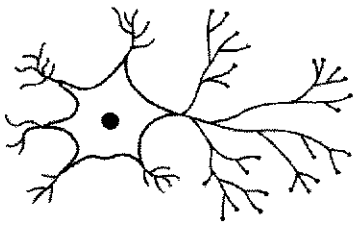


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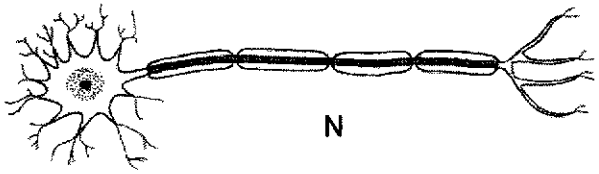
23 The diagrams show three types of neurones.



L



M



N

Not drawn to scale

Which sequence shows the direction that impulses will travel during a reflex action?

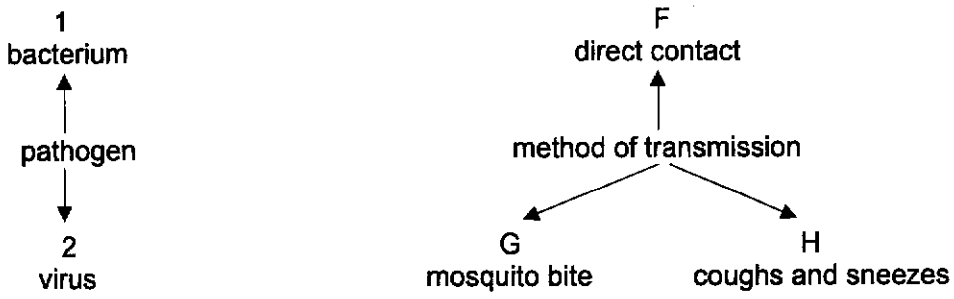
A L → M → N

B M → L → N

C M → M → L

D N → M → L

24 The diagram shows some of the pathogens that cause disease in humans and some of the ways they are transmitted.



What is the correct pathogen and methods of transmission for influenza?

A 1, F and H

B 1, G and H

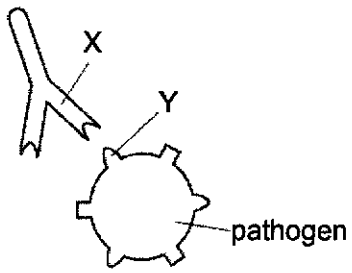
C 2, F and G

D 2, F and H

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25 When a pathogen enters the blood, the immune system uses different mechanisms to destroy the pathogen.

The diagram shows one of these mechanisms.



Which row describes the structures involved?

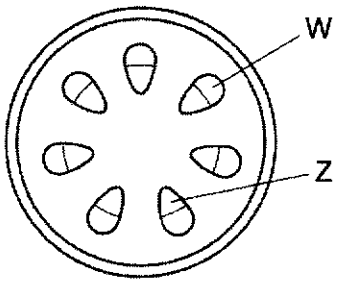
	structure X	X is made by	structure Y
A	antibody	lymphocytes	antibody
B	antibody	phagocytes	antigen
C	antigen	lymphocytes	antibody
D	antigen	phagocytes	antigen

26 What is an example of an infectious and non-infectious disease?

	infectious disease	non-infectious disease
A	AIDS	fatty liver
B	coronary heart disease	asthma
C	fatty liver	coronary heart disease
D	influenza	AIDS

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27 The plan diagram of a transverse section through a dicotyledonous plant stem was drawn by a student. They had stained the section with a chemical that stains lignin.



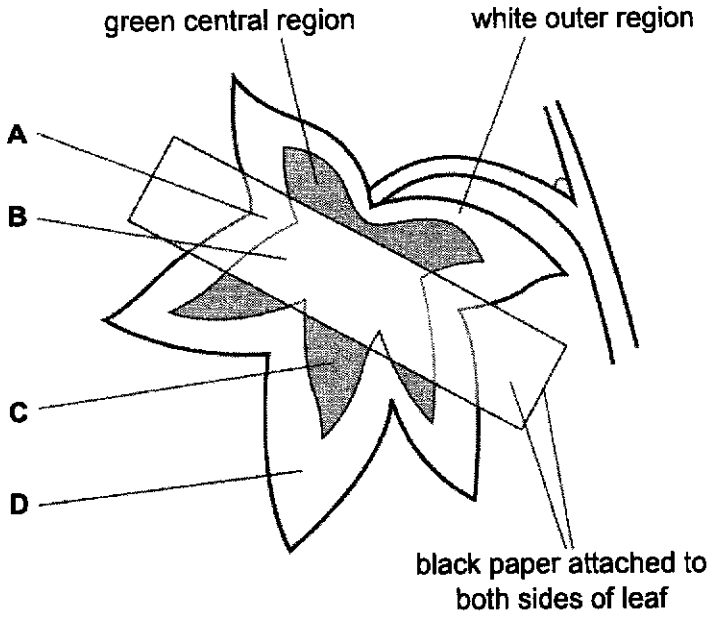
Which row is correct for tissues W and Z?

	W	Z	stained tissue
A	phloem	xylem	W
B	phloem	xylem	Z
C	xylem	phloem	W
D	xylem	phloem	Z

28 A plant with variegated leaves was placed in a dark cupboard for 48 hours so that all the starch was removed from the leaves.

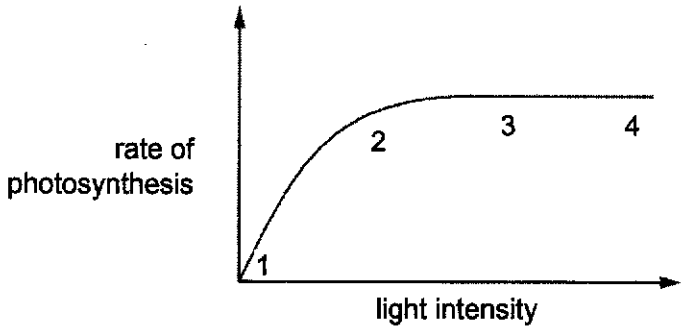
The variegated leaves have green parts and white parts. Black paper was then fixed on one leaf and the plant was exposed to light.

After 24 hours, which region of the leaf contained starch?



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29 The graph shows the rate of photosynthesis with increasing light intensity.



Where is light intensity a limiting factor for photosynthesis?

A between 1 and 2

B between 1 and 3

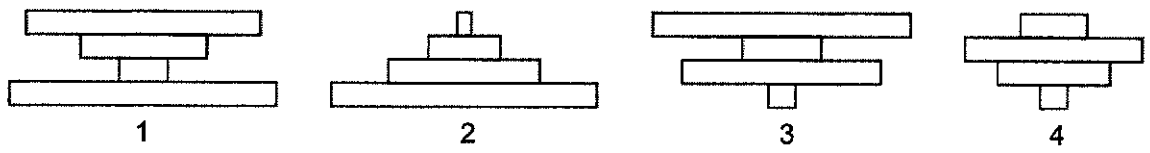
C between 2 and 4

D between 3 and 4

30 Which combination of environmental factors will cause the largest increase in the transpiration rate in a plant?

	humidity	temperature	light intensity
A	high	high	low
B	high	low	high
C	low	high	high
D	low	low	low

31 A tree has insect larvae burrowing in its leaves. The emerging insects are eaten by birds and the birds have parasitic fleas living amongst their feathers.



Which pyramid is a pyramid of biomass and which pyramid is a pyramid of numbers for this food chain?

	pyramid of biomass	pyramid of numbers
A	1	3
B	1	4
C	2	3
D	2	4

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32 The fossil fuels used as energy sources today developed from animal and plant remains buried millions of years ago.

What was the initial source of the energy in these fossil fuels?

A heat rising from the centre of the Earth trapped by the fuels

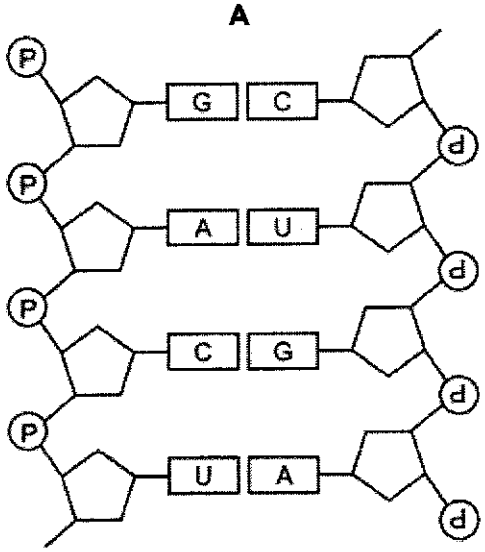
B heat released by decomposers feeding on dead animals and plants

C light energy absorbed by producers

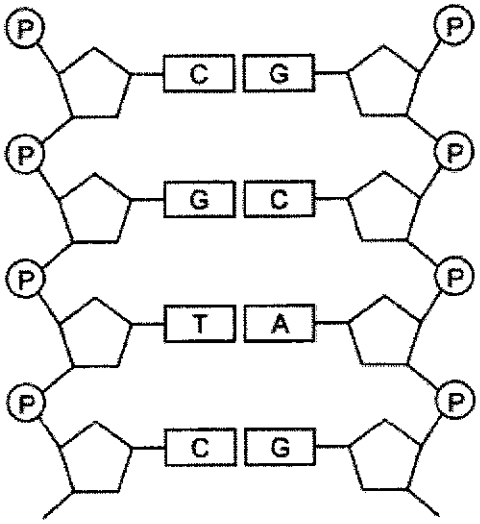
D metabolic activity of the animals and plants in the oceans

33 Which diagram correctly shows the structure of a piece of DNA?

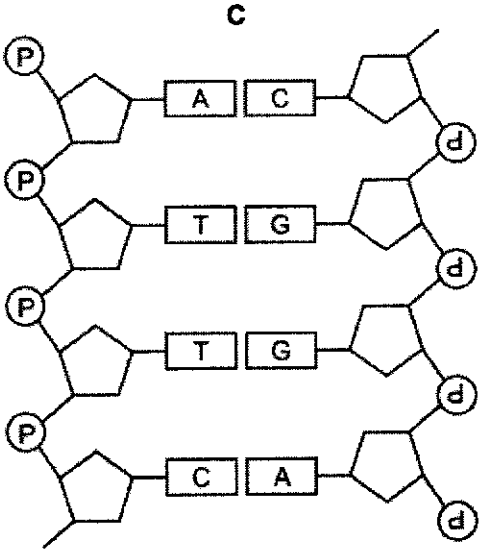
A



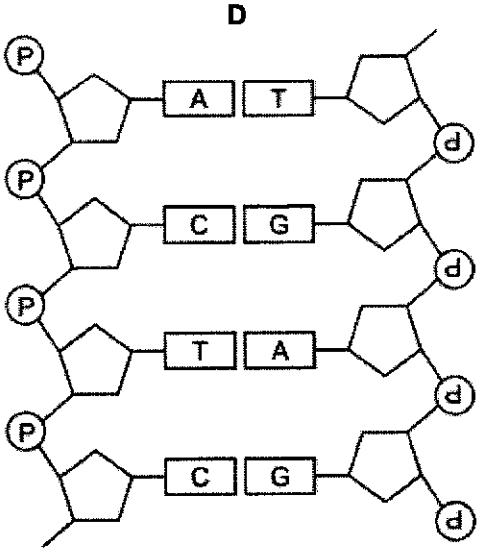
B



C



D



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34 Sickle cell anaemia is caused by a mutation in an allele of the gene that codes for the β-globin polypeptide of haemoglobin.

The diagram shows the sequence of bases in a small section of the template strand of DNA for both the Hb^A (normal) and Hb^S (sickle cell) β-globin alleles.

Hb^A CTGACTCCTGAGGAGAAGTCT
Hb^S CTGACTCCTGTGGAGAAGTCT

Both the polypeptides for Hb^A and Hb^S are the same length.

How will the mutation in the allele result in the production of an altered version of the β-globin polypeptide?

A All the amino acids coded for after the mutation will differ from those in the Hb^A protein.

B mRNA transcribed from the Hb^S allele will contain the codon CAC instead of the codon CTC.

C The mutation results in a different amino acid coded for in the Hb^S allele.

D The ribosome will be unable to continue translation of the Hb^S mRNA after the altered codon.

35 Two polynucleotide strands make up a DNA molecule. Which description is correct?

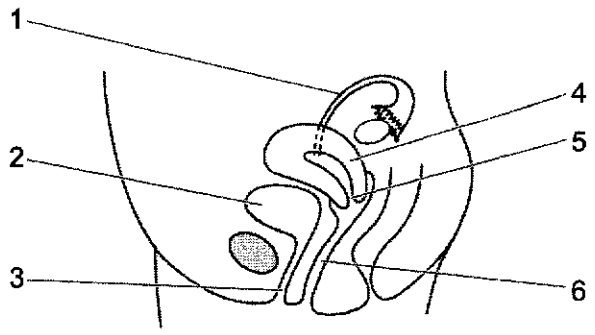
A The percentage of cytosine is 50% of that of guanine in the whole molecule.

B The percentage of cytosine is the same as that of guanine in the whole molecule.

C The percentage of cytosine is the same as that of guanine in each strand.

D The percentage of cytosine is the same in each strand of the molecule.

36 The diagram shows the female reproductive system.



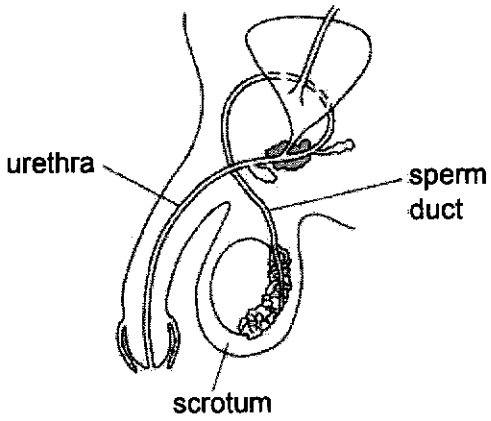
Which row correctly labels the diagram?

	1	2	3	4	5	6
A	bladder	urethra	ureter	oviduct	uterus	cervix
B	oviduct	bladder	urethra	uterus	cervix	vagina
C	oviduct	bladder	urethra	ureter	uterus	cervix
D	urethra	bladder	ureter	uterus	cervix	vagina

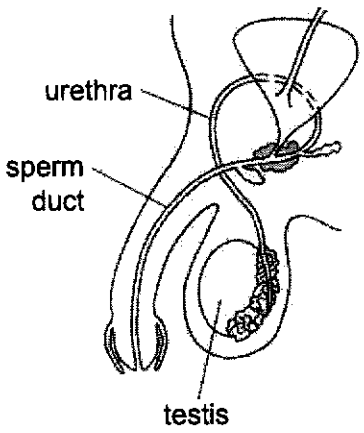
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37 Which diagram of the male reproductive system is correctly labelled?

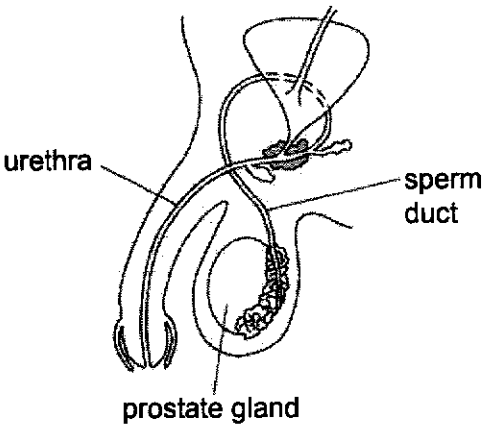
A



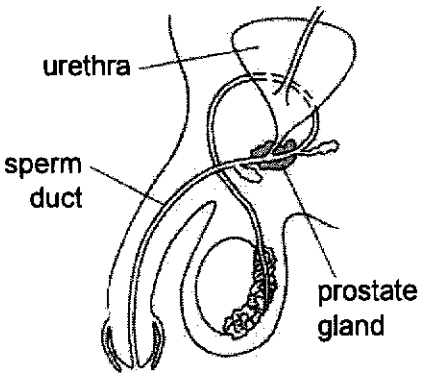
B



C



D



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38 Chlamydia, gonorrhoea and syphilis are sexually transmitted infections (STIs).

The table shows the numbers of people infected with these STIs in one country from 2014 to 2018.

year	number of people infected		
	chlamydia	gonorrhoea	syphilis
2014	1 400 000	350 000	19 000
2016	1 600 000	468 000	27 000
2018	1 800 000	583 000	35 000

The list shows some conclusions.

1 In 2014, there were 1050000 more people infected with chlamydia than were infected with gonorrhoea in 2014.
2 In 2016, the number of people infected with chlamydia was three times greater than the number of people infected with gonorrhoea.
3 In 2018, more people were infected with syphilis than with gonorrhoea.
4 The number of people with STIs has increased each year.
5 Between 2016 and 2018, the number of people infected with syphilis increased by 16000.

Which of the following are the correct conclusions?

A 1, 2 and 4

B 1 and 4

C 2, 3 and 5

D 4 and 5

39 Which types of variation can be inherited?

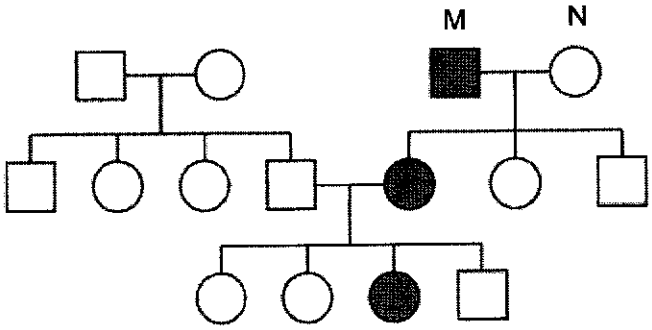
	variation caused by genes	variation caused by the environment
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key

✓ = yes
✗ = no

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40 The diagram shows the inheritance of the allele, **E**, for polydactyly (having extra fingers) which is dominant over the allele for no extra fingers, **e**.



key

- male without extra fingers
- male with extra fingers
- female without extra fingers
- female with extra fingers

What are the genotypes of persons M and N?

	M	N
A	EE	ee
B	Ee	Ee
C	Ee	ee
D	ee	ee

END OF PAPER

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Secondary 4 Biology

2024 Preliminary Examination Suggested Answer

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

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1(a)(i)	root hair cell + long and narrow protrusion	1
1(a)(ii)	1 soil water has a higher water potential than the cell sap of root hair cell / cell A 2 hence, water molecules moved from soil water to the cell sap of root hair cell / cell A via osmosis through a partially permeable membrane 3 cell sap of root hair cell now has a higher water potential than cell sap of cortical cells leading to water molecules moving into the cell sap of cortical cells 4 this process continues until water molecules reaches the xylem vessel	3
1(b)(i)	still air: graph C moving air: graph B	1
1(b)(ii)	1 In the presence of moving air, there is a greater mass of water lost from 0 to 30 minutes, where the greatest mass of water lost is (6.1 – 2.1 =) 4.0 g at 30 min 2 Moving air removes the layer of water vapour immediately outside the leaves, reducing / lowering the concentration gradient of water vapour between the intercellular air spaces and the atmospheric air compared to the plant in still air 3 Hence, there is a higher net rate of water vapour diffusing out of the intercellular air spaces (through the stomata) to the atmospheric air in the plant exposed to moving air	3
1(c)(i)	252	1
1(c)(ii)	any three from: 1 (carbon dioxide / ^{14}C) enters (leaf), through stoma(ta) / by diffusion and diffuses into the chloroplast 2 photosynthesis occurs and radioactive carbon dioxide is converted to glucose in the presence of light energy and chlorophyll 3 excess glucose is then converted to sucrose for transportation	3
		[Total: 12]
2(a)	D	1
2(b)(i)	1 test-tube 3 contained bile but test-tube 2 did not. Bile emulsifies large fat droplets into smaller fat droplets 2 increases surface area to volume ratio of fats for a faster rate of digestion by lipase into fatty acids and glycerol in test-tube 3 than 2 3 since fatty acids are acidic, hence, pH in test-tube 3 decreases faster / at an earlier time than test-tube 2	3
2(b)(ii)	any one from: 1 shows that bile, does not (chemically) digest fats / does not make solution acidic ; 2 shows that, lipase / enzyme, is required (for breakdown of fats into fatty acids and glycerol)	1

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