ZHONGHUA SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2019

SECONDARY 4E

Candidate's Name	Class	Register Number
	4E4	

BIOLOGY 6093 /01

20 September 2019
1 hour

Additional Materials: OTAS

READ THESE INSTRUCTIONS FIRST

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

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.

Total	/ 40

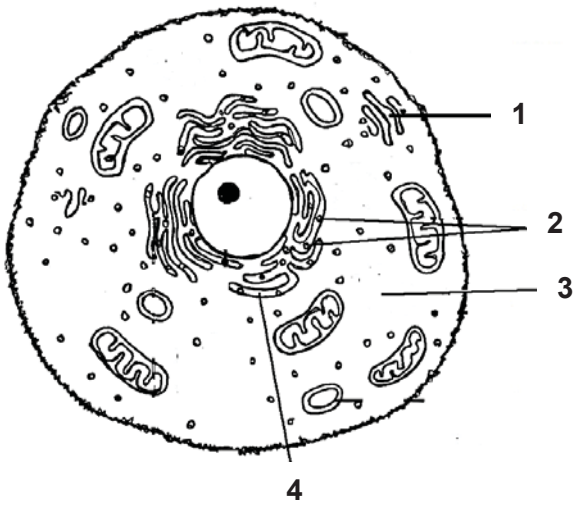
Setter: Ms Rozianna
Vetter: Mr Goh Tze Mian

This document consists of **20** printed pages, including this cover page.

Section A

Answer **all** questions in the OTAS.

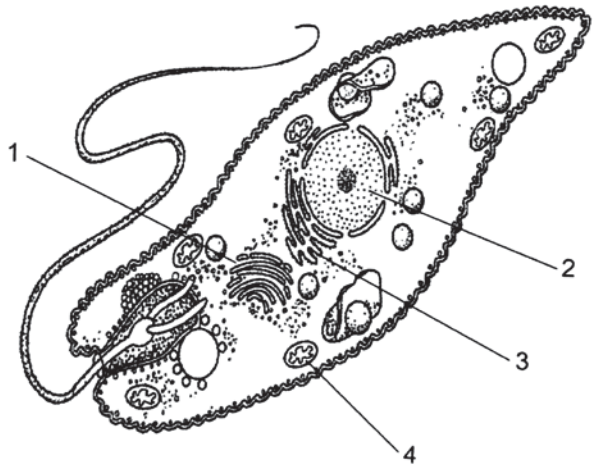
1 The diagram shows a typical animal cell with cell components involved in the synthesis and secretions of an enzyme.



Which is the correct route taken by an amino acid molecule during enzyme production?

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

2 The diagram shows a freshwater single-celled organism.



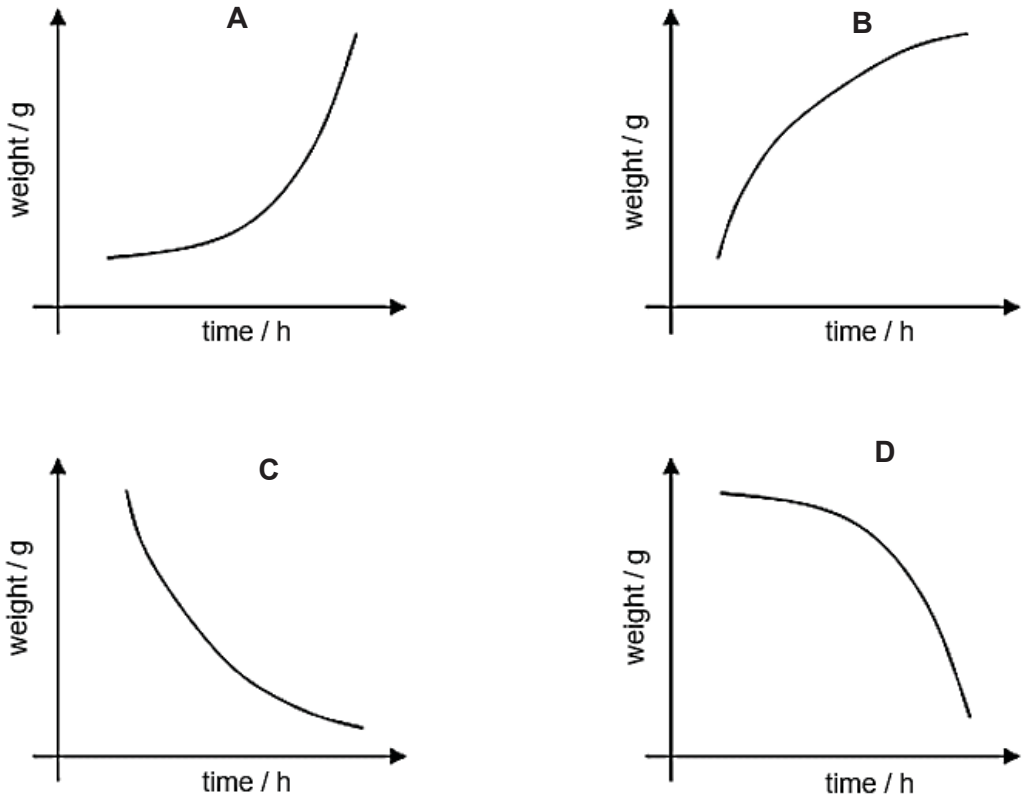
Which of the statements correctly identifies structures 1 to 4 and its function?

1 smooth endoplasmic reticulum synthesises fats and steroids
2 chromosomes control polypeptide synthesis
3 Golgi body synthesizes proteins
4 chloroplast captures light energy for photosynthesis

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

3 Concentrated starch solution is added into a cow's urinary bladder until it is half full. The bladder is tied, weighed and then placed in a dilute starch solution. The weight of the urinary bladder is taken every hour.

Which graph best reflects these results?



4 The diagram shows a xerophytic leaf in different conditions, **P** and **Q**.

condition **P** condition **Q**

Which statements about the cells of the leaf in conditions **P** and **Q** are correct?

1 water potential in condition **P** is higher than in condition **Q**
2 cells may be turgid in condition **P** and plasmolysed in condition **Q**
3 turgidity of cells in condition **P** is lesser than in condition **Q**
4 no net diffusion of water into cells in layer **X** in either condition **P** or **Q**

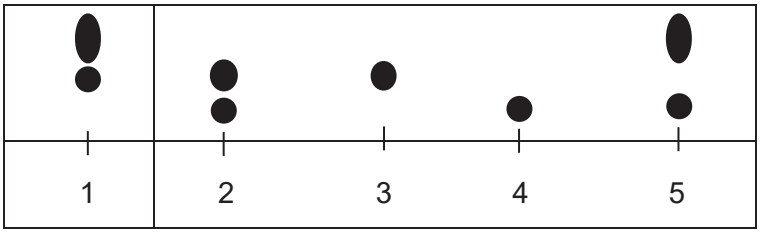
A 1 and 4

B 2 and 3

C 1, 2 and 4

D 1, 2, 3 and 4

5 Five disaccharides were each hydrolysed with dilute acid and the purified products were separated by chromatography. The results are shown below.



The spots from 1 represent the products obtained from the hydrolysis of sucrose.

Which represents the results obtained from the hydrolysis of lactose and maltose?

	lactose	maltose
A	2	3
B	2	4
C	5	2
D	5	3

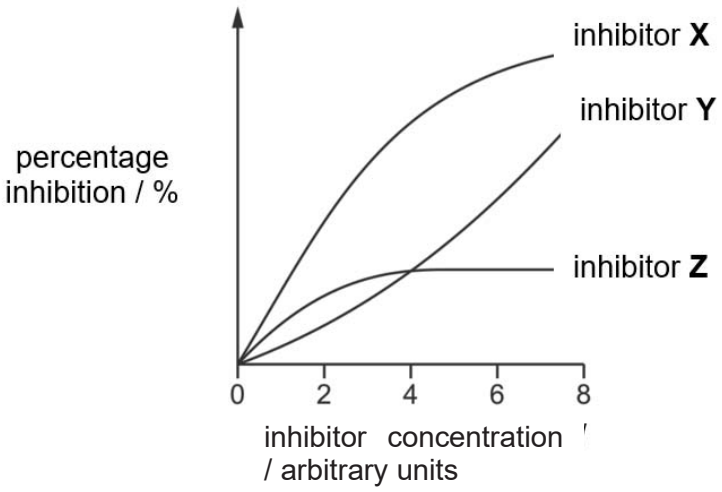
6 Lipase catalyses the conversion of fats into fatty acids and glycerol.

$$\text{fats} \xrightarrow{\text{lipase}} \text{fatty acids} + \text{glycerol}$$

Three different enzyme inhibitors of lipase **X**, **Y** and **Z,** which prevent the above reaction from occurring, were investigated.

The percentage inhibition of lipase was measured at different concentrations of inhibitor.

The graph shows the results of the investigation.

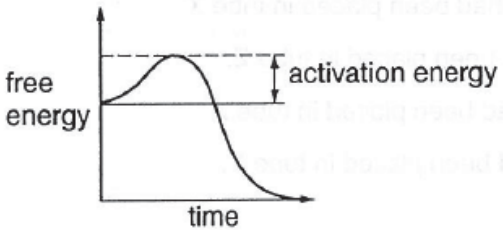


Which is/are valid conclusion(s) from these results?

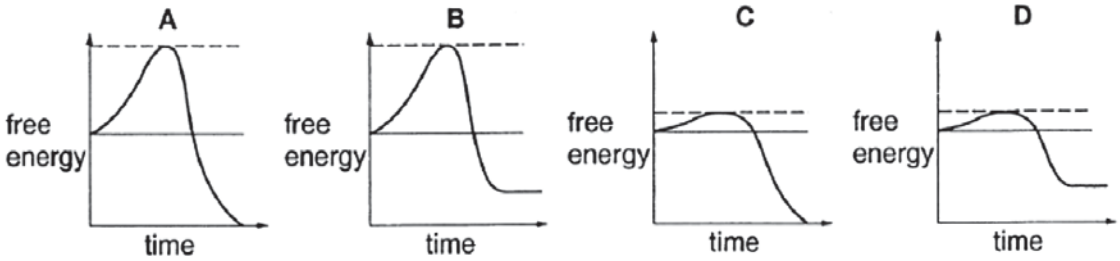
1 The higher the concentration of inhibitor **X**, the lesser the amount of fats is broken down.
2 The production of fatty acids and glycerol using inhibitor **Y** is higher than when inhibitor **Z** is used.
3 The production of fatty acids and glycerol at an inhibitor concentration of 2 arbitrary units is lower than at an inhibitor concentration of 4 arbitrary units, for all inhibitors.

A 1 only **B** 3 only **C** 1 and 2 **D** 2 and 3

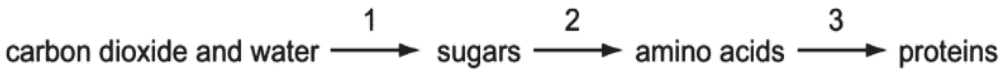
7 The graph shows energy changes during an enzyme-catalysed chemical reaction.



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



8 The diagram shows some chemical reactions that occur in plants.



Which stage/s depend/s on the use of nitrate ions as a raw material?

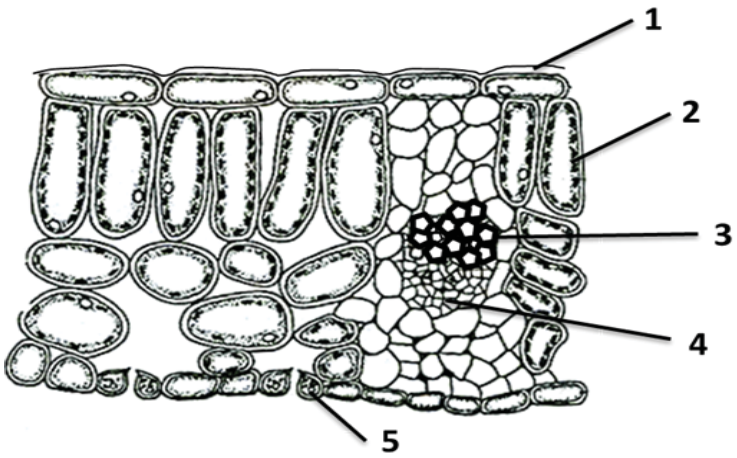
A 1 only

B 2 only

C 1 and 3

D 2 and 3

Refer to the diagram of a dicotyledonous leaf to answer questions **9** and **10**.



9 A drop of concentrated salt solution was placed on the surface of the leaf at 1.

Which statement describes the movement of water molecules between the salt solution and the plant cells in the leaf?

A There is no movement of water molecules between the salt solution and the plant cells.

B There is no net movement of water molecules between the salt solution and the plant cells.

C Water molecules move from the plant cells into the salt solution by osmosis.

D Water molecules move from the salt solution into the plant cells by osmosis.

10 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

11 Which process is an example of assimilation?

A formation of carbon dioxide from glucose

B formation of cell membranes using lipids

C formation of sweat from blood plasma

D formation of urea from amino acids

12 In patients with cystic fibrosis, thick mucus blocks the pancreatic duct.

Which are possible effects of this blockage?

1 egesting oily stool
2 weight loss
3 malnourishment
4 hyperglycemia (high blood glucose)

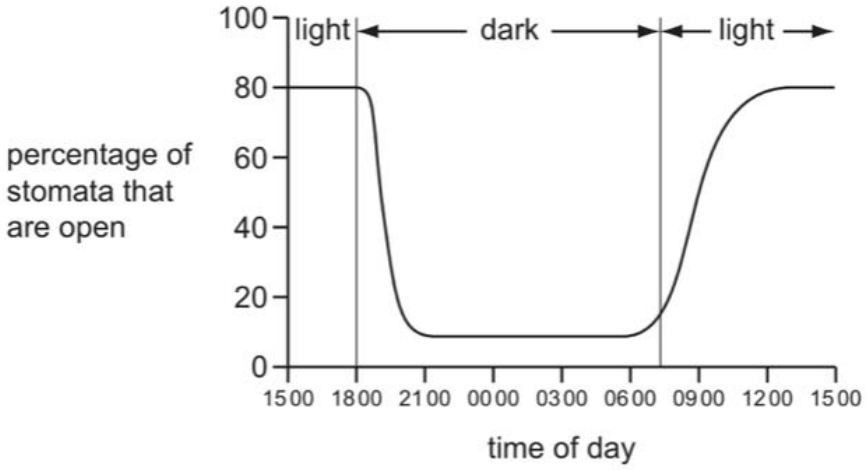
A 1 and 3

B 1, 2 and 3

C 1, 3 and 4

D 2 and 3

13 The graph shows stomatal opening and closing in leaves during a 24-hour period.



What can be concluded from the graph?

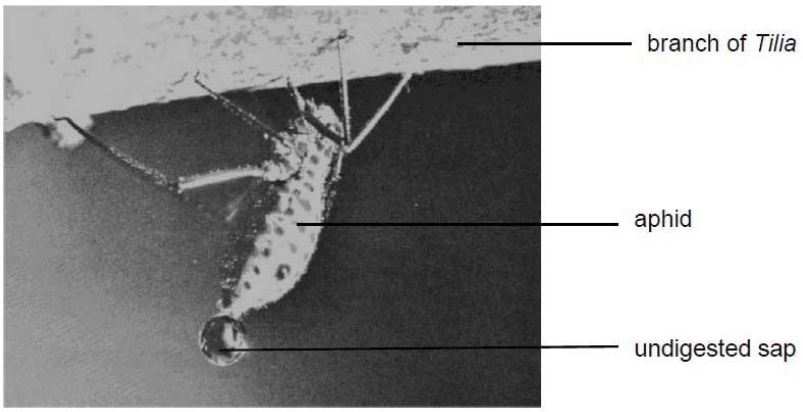
A Gaseous exchange occurs when stomata are open.

B Stomata open as light intensity increases.

C Gaseous exchange does not occur in the dark.

D Transpiration does not occur in the dark.

14 The photomicrograph shows an aphid feeding on a branch of a woody tree, *Tilia*. The fluid extracted by the aphid consists of sieve element sap. The high turgor pressure in the sieve element forces the cell contents through the food canal of the aphid. Once every 30 minutes, a droplet of undigested sap exits from the aphid. Plants exhibiting extensive aphid damage can display a variety of symptoms, such as decreased growth rates, stunted growth, low yields and death.



Which pair of observation and explanation is correct?

	observation	explanation
A	sieve element sap	rich in solutes, especially sucrose and amino acids
B	high turgor pressure in sieve element	numerous mitochondria in sieve tubes to carry out active transport
C	undigested sap	product of defecation and not excretion
D	variety of symptoms	due to low levels of manufactured food substances left for *Tilia* plant

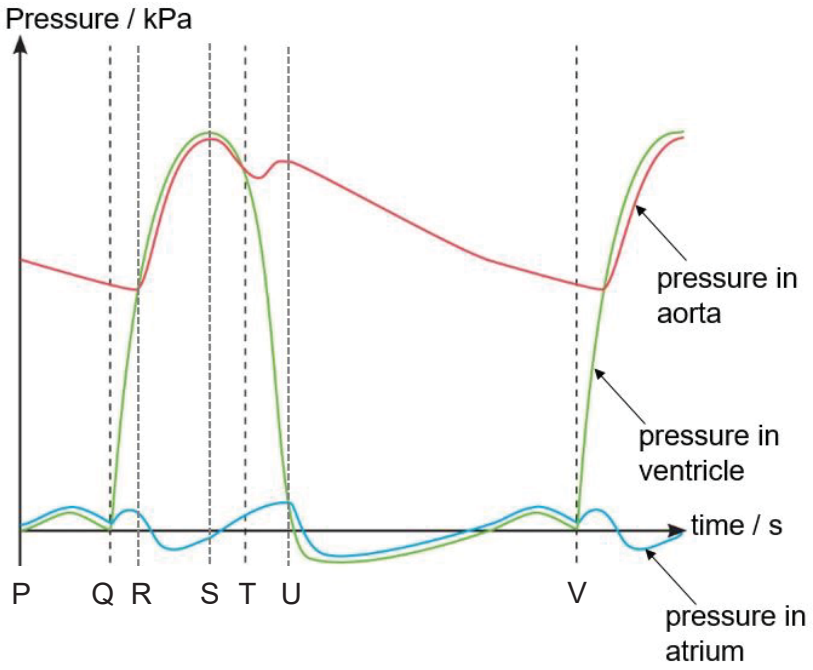
15 Blood samples from three veins in the body were tested for the concentration of oxygen, carbon dioxide and urea. The results, in arbitrary units, are shown in the table.

vein	oxygen concentration	carbon dioxide concentration	urea concentration
1	40	48	1.3
2	40	48	7.5
3	90	40	3.9

What are the identities of the three veins?

	hepatic vein	pulmonary vein	renal vein
A	1	3	2
B	2	3	1
C	3	1	2
D	3	2	1

16 The graph below shows the pressure changes in the left side of the heart. The letters P, Q, R, S, T, U and V represent time in seconds.



At which time frame does ventricular systole take place?

A between Q and S
B between Q and T
C between Q and U
D between P and Q

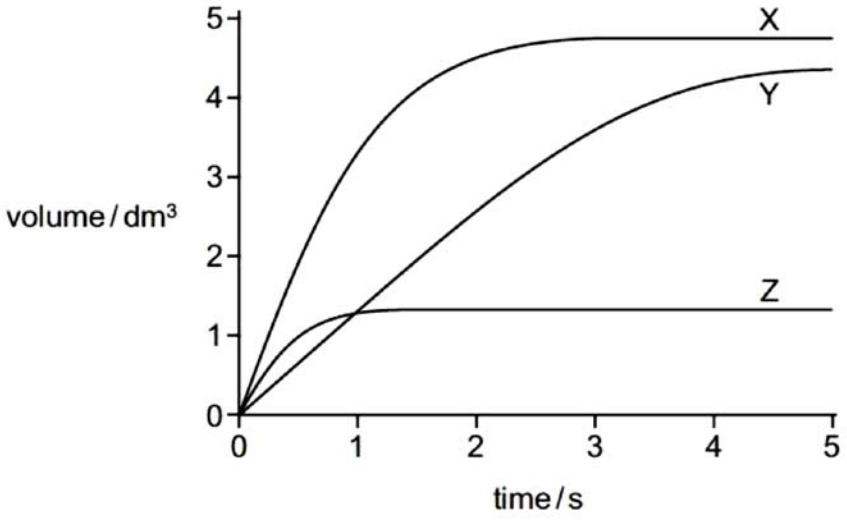
17 The table shows the results of a blood test of three volunteers, P, Q and R for blood transfusion.

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

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

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

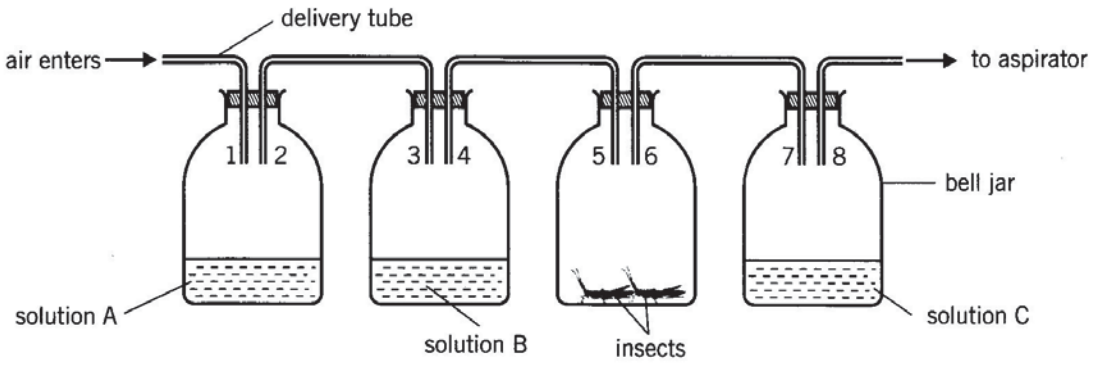
18 The graph shows the volume of air deeply inhaled by three different people, X, Y and Z immediately after breathing out quickly and with force.



What is an explanation for the differences?

	chronic bronchitis	emphysema	healthy lung function
A	X	Y	Z
B	X	Z	Y
C	Y	Z	X
D	Z	Y	X

For questions **19** and **20**, refer to the experimental set-up below. The set-up investigates respiration using living insects. Positions 1 to 8 indicate the end part of the delivery tube.



19 Which is the best suggestion to rectify the mistake in the experimental set-up?

A Air should enter from tube 8 instead of tube 1.

B The insects should be replaced with freshwater fish as it is a more effective organism to study respiration.

C The end part of delivery tubes at 2 and 4 should be dipped into the solution to let the air flow through solutions A, B and C.

D The end part of delivery tubes at 1, 3 and 7 should be dipped into the solution to let the air flow through solutions A, B and C.

20 Assuming that the experimental setup has been rectified, which correctly identifies solution A and its purpose?

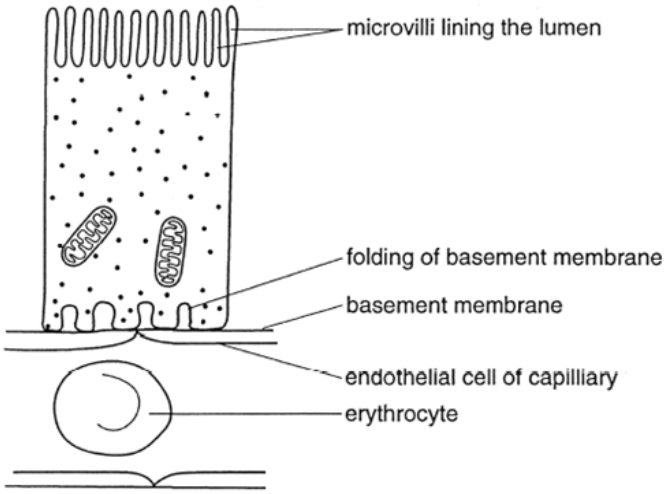
A Bicarbonate solution. To detect carbon dioxide released by living organism during respiration.

B Sodium hydroxide solution. To remove atmospheric carbon dioxide.

C Potassium hydroxide solution. To detect carbon dioxide released by living organism during respiration.

D Bicarbonate solution. To remove atmospheric carbon dioxide.

21 The diagram shows the ultrastructure of a nephron with part of an adjacent blood capillary.



Which part of the nephron was this taken from?

A afferent arteriole

B Bowman's capsule

C glomerulus

D proximal convoluted tubule

22 Which statement correctly describes control by negative feedback?

A An injury to body tissue activates platelets in the blood and these activated platelets release chemicals which activate more platelets.

B During a menstrual cycle, luteinising hormone stimulates the release of oestrogen which in turn stimulates the release of more luteinising hormone.

C The onset of contractions during childbirth causes the release of a hormone, which stimulates further contractions.

D When blood pressure is high, nerve impulses from the brain cause the blood vessels to dilate and blood pressure is reduced.

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

What could have caused this?

A Receptors in his hand were damaged.

B Relay neurones in his hand could no longer function.

C The nerve connection was cut only between the receptors in his hand and his central nervous system.

D The nerve connection was cut only between his central nervous system and the effectors in his arm.

24 Our eyes feel strained when we read small prints for a long period of time.

Which of the following is the correct explanation for the incident described above?

A The suspensory ligaments become stretched.

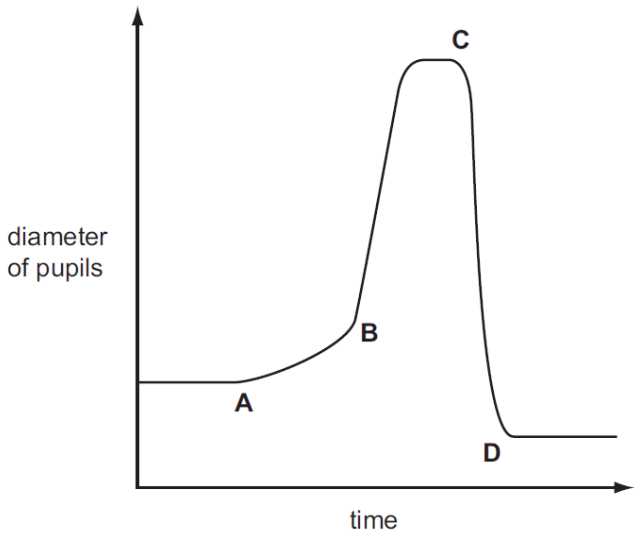
B The retina will no longer record clear images.

C The optic nerve will no longer transmit impulses to the brain.

D The ciliary muscles become fatigued.

25 The graph shows changes in the diameter of a person's pupils while outdoors on a sunny day.

At which time did the person take off a pair of sunglasses?



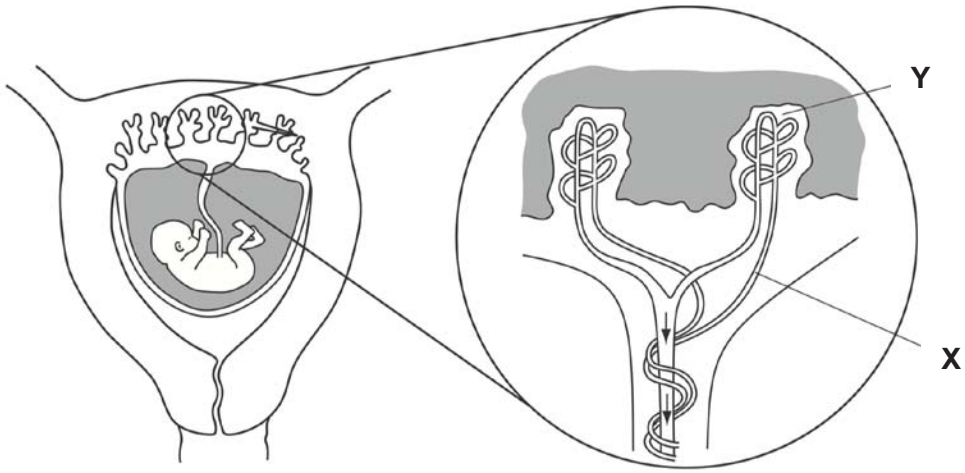
26 Insulin is injected into a diabetic patient rather than taken orally. This is because insulin

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

Which statement(s) are correct?

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

27 The diagram shows a fetus in the uterus.



Which substance will be at a lower concentration at **X** than at **Y**?

A carbon dioxide and glucose
B carbon dioxide and urea
C glucose and oxygen
D oxygen and urea

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

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

A 1, 2 and 3
B 1, 3 and 4
C 2, 3 and 5
D 2, 4 and 5

29 The table shows information about flowers of three different plants.

flower characteristics	plant X	plant Y	plant Z
petal colour	white	purple	bright yellow
aroma	none	pungent smell	sweet smell
petal size	0.4 cm	10.2 cm	3.9 cm
nectar volume	none	medium amount	large amount

Which inference is valid about the method of pollination for plants X, Y and Z?

A All three plants are wind pollinated.

B All three plants are insect pollinated.

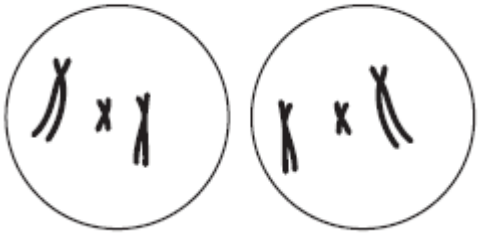
C Plant X is wind pollinated but plants Y and Z are insect pollinated.

D Plants X and Y are insect pollinated but plant Z is wind pollinated.

30 The diagram shows the chromosomes in a cell.

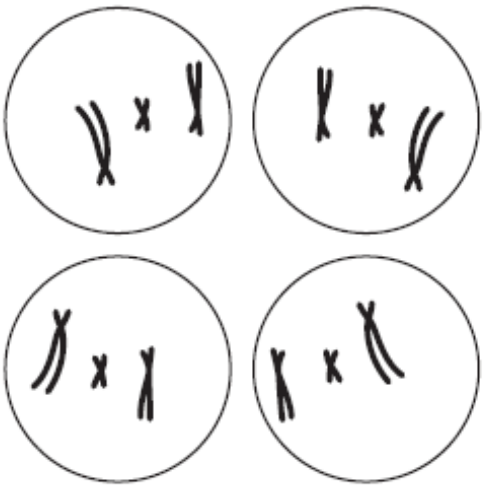
Which diagram shows the product of **one** division of the cell by mitosis?

A



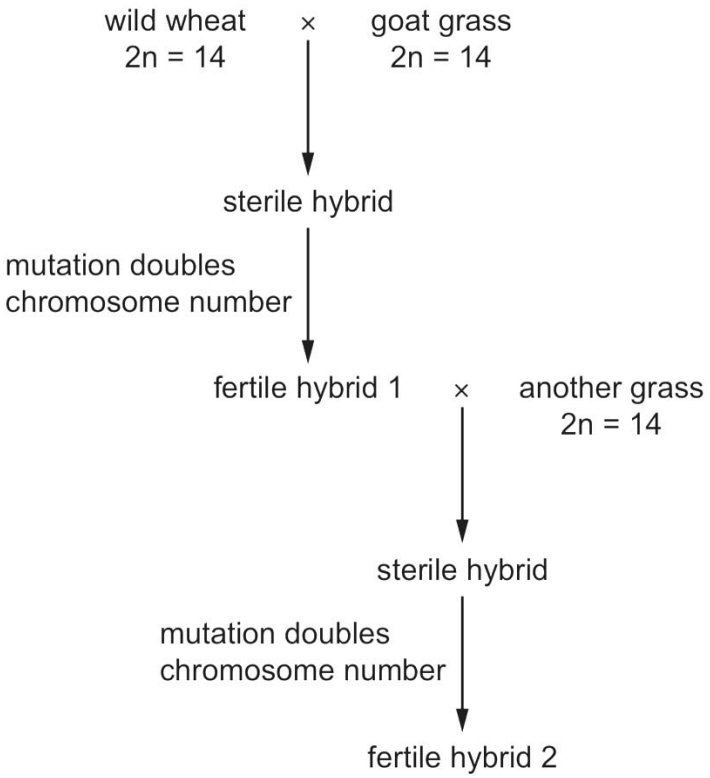
B

C



D

31 The diagram shows crosses between wild wheat and two types of grass.

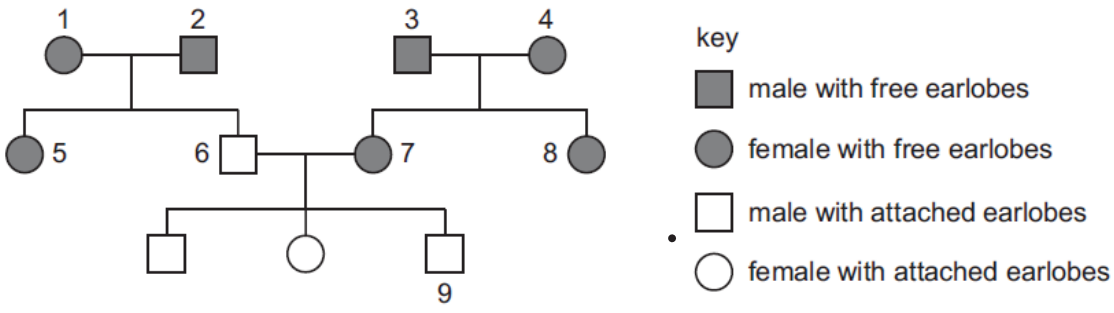


What is the chromosome number of fertile hybrid 2?

A 28 **B** 42 **C** 56 **D** 140

32 Earlobes can either be attached to the cheek or 'free' (unattached). This characteristic is controlled by a single gene.The allele for attached earlobes is recessive.

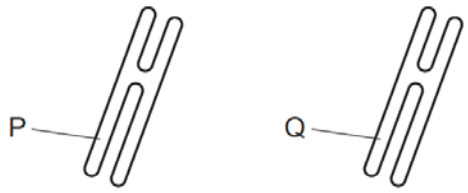
The diagram shows the inheritance of earlobe attachment in one family.



Which two individuals must be heterozygous for earlobe attachment?

A 1 and 7
B 3 and 4
C 5 and 8
D 6 and 9

33 The diagram shows a pair of chromosomes from the same cell.



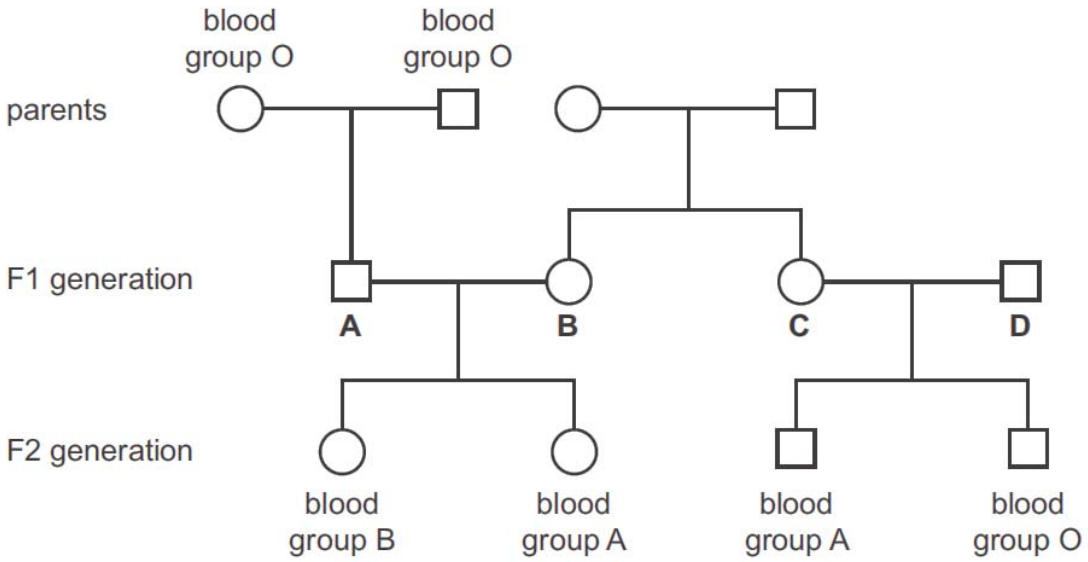
A gene is found at the point labelled P.

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

A a different allele of a different gene
B a different allele of the same gene
C a different gene of the same allele
D the same gene of the same allele

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

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



35 In fruit flies, the allele for an ebony-coloured body is recessive to the allele for a grey-coloured body. In an investigation, an ebony-bodied fly is crossed with a grey-bodied fly.

What will be the body colour of the offspring if the grey-bodied fly is heterozygous?

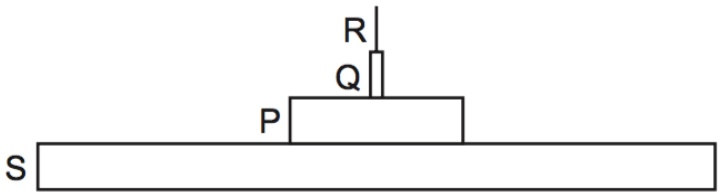
A all ebony
B all grey
C half ebony and half grey
D three-quarters grey and one-quarter ebony

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

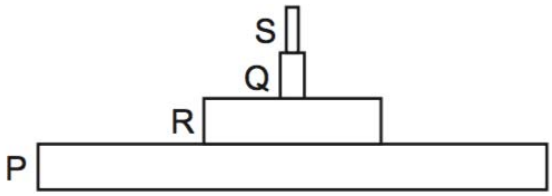
species	number of individuals	biomass of one individual / arbitrary units	energy value per unit mass / arbitrary units
P	10 000	0.100	1.0
Q	5	10.000	2.0
R	500	0.002	1.8
S	3	300 000.000	0.5

Which is the correct pyramid of energy from these data?

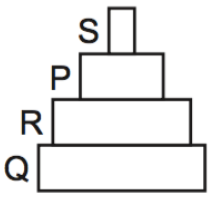
A



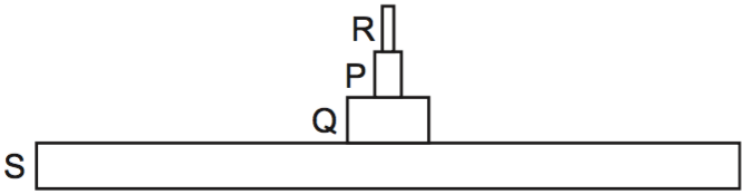
B



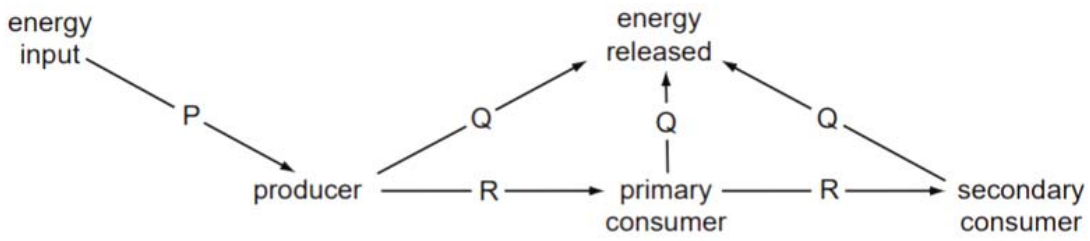
C



D



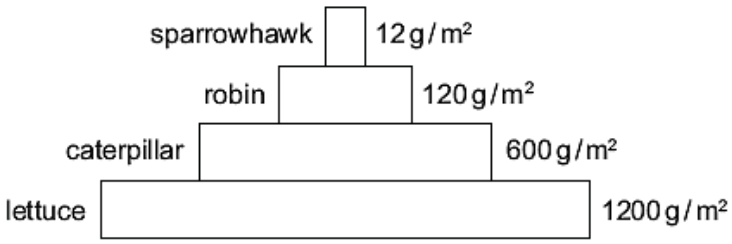
37 The diagram shows the flow of energy in a food chain.



What are the forms of energy P, Q and R?

	P	Q	R
A	chemical	light	heat
B	heat	chemical	light
C	light	chemical	heat
D	light	heat	chemical

38 The diagram shows a pyramid of biomass.



Which percentage of biomass is passed from the primary consumer to the secondary consumer?

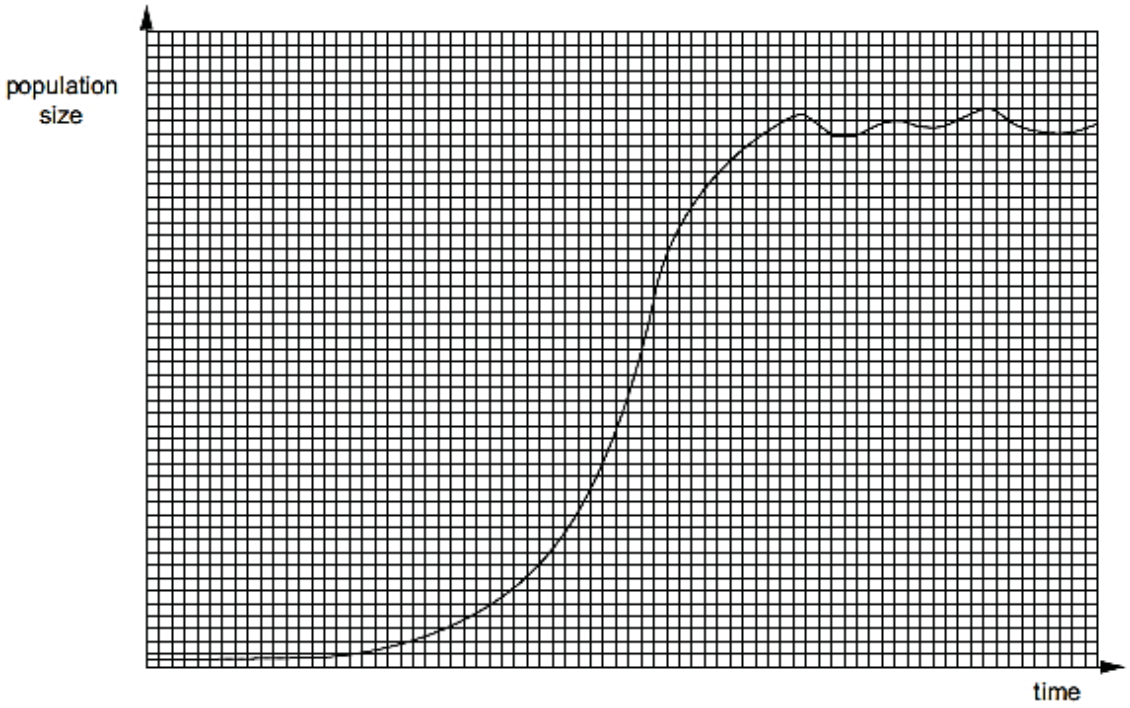
A 1%

B 10%

C 20%

D 90%

39 Some rabbits colonised an island for the first time. The graph shows how their population size changed over the next few years.



What explains the way the size of the rabbit population changed during the exponential (rapidly increasing) phase?

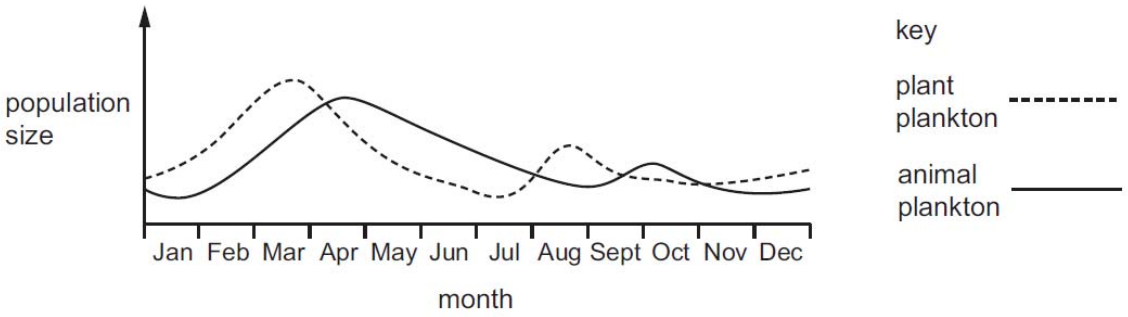
A limiting factors begin to take effect

B increase in the number of predators

C birth rate and death rate in equilibrium

D increasing number of rabbits able to reproduce

40 The graph shows changes in the populations of plant and animal plankton in a lake.



Consider the following statement in relation to the data provided by the graph.

'Population changes in animal plankton lag behind similar changes in plant plankton because the animals feed on the plants.'

Into which category does the statement fall?

A It is a reasonable interpretation of the data.

B It is a restatement of the data, not an interpretation.

C It is contradicted or not supported by the data.

D More data are required in order for this interpretation to be made.

END OF PAPER