Candidate Name:	Class	Index No.
	4E1	

FUHUA SECONDARY SCHOOL

Secondary Four Express

Preliminary Examination 2018

4E

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BIOLOGY 6093/01

27 Aug 2018
1045 - 1145
1 hour

Additional Material: OMR 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 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.

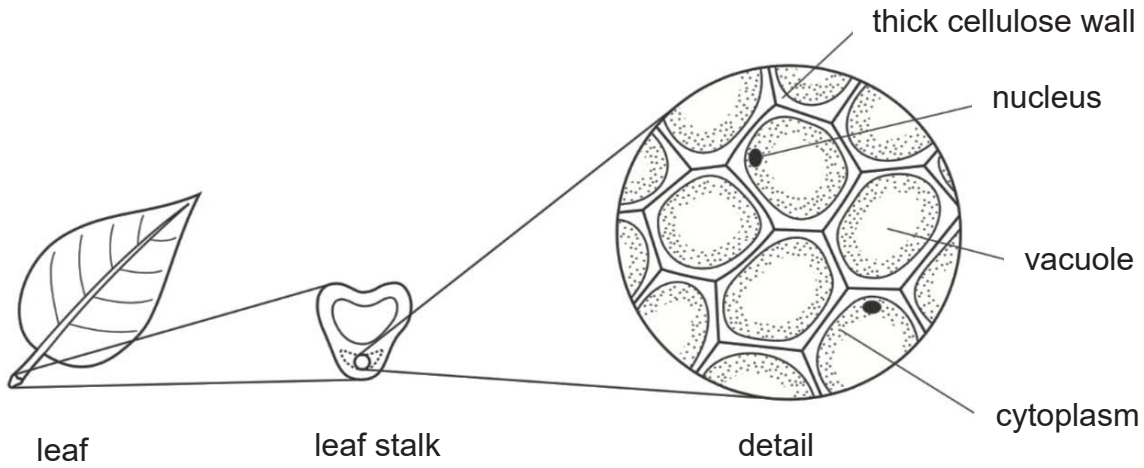
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
The use of an approved scientific calculator is expected where appropriate.

PARENT'S SIGNATURE	FOR EXAMINER'S USE
	/ 40

This question paper consists of 21 printed pages including this page.

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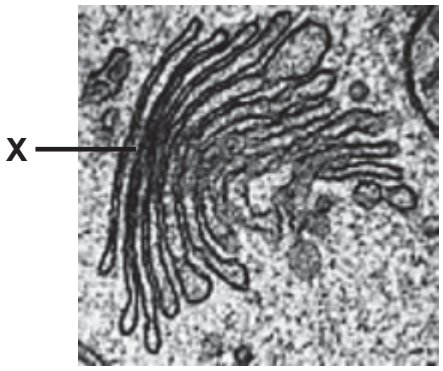
1 The diagrams show structures associated with a leaf.



What is the level of organisation of the part shown in detail?

A cell **B** organ **C** organ system **D** tissue

2 The photomicrograph shows part of an animal cell.



Which of the following describes the correct functional relationship between structure **X** and the rough endoplasmic reticulum?

A Polypeptides synthesised at the rough endoplasmic reticulum are transported to **X** to be stored for regular use in the cytoplasm.

B Polypeptides synthesised at **X** are packaged into vesicles that move to the rough endoplasmic reticulum for further modification.

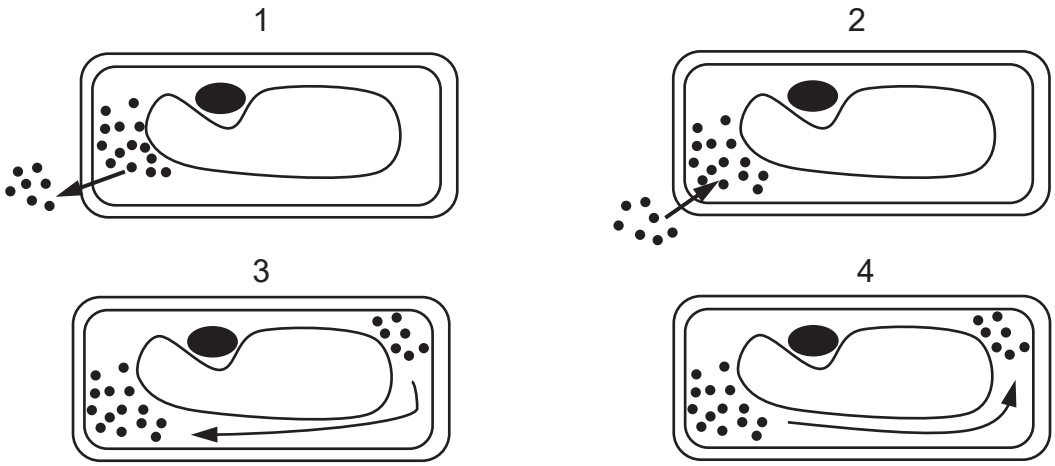
C Polypeptides synthesised at the rough endoplasmic reticulum are transported to **X** where they are modified into functional proteins for secretion.

D Polypeptides synthesised at **X** are packaged directly for secretion without moving to the endoplasmic reticulum.

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3 The diagrams show four plant cells with the arrows representing the direction of movement of molecules.

Which diagram(s) represents the occurrence of active transport?



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

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



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

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

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

A 1 and 4

B 2 and 3

C 1, 2 and 4

D 1, 2, 3 and 4

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5 Which substance(s) contains carbon, hydrogen, oxygen and nitrogen?

1 cellulose
2 deoxyribonucleic acid
3 glucagon

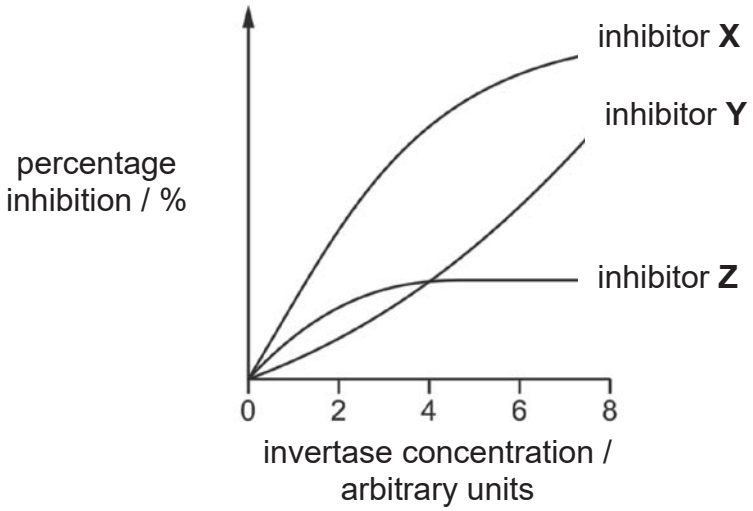
A 2 only **B** 1 and 2 **C** 1 and 3 **D** 2 and 3

6 Invertase catalyses the conversion of sucrose to glucose and fructose.

$$\text{sucrose} \xrightarrow{\text{invertase}} \text{glucose} + \text{fructose}$$

Three different enzyme inhibitors of invertase **X**, **Y** and **Z,** which prevent the above reaction from occurring, were investigated. The percentage inhibition of invertase was measured at different concentrations of inhibitor.

The graph shows the result of the investigation.



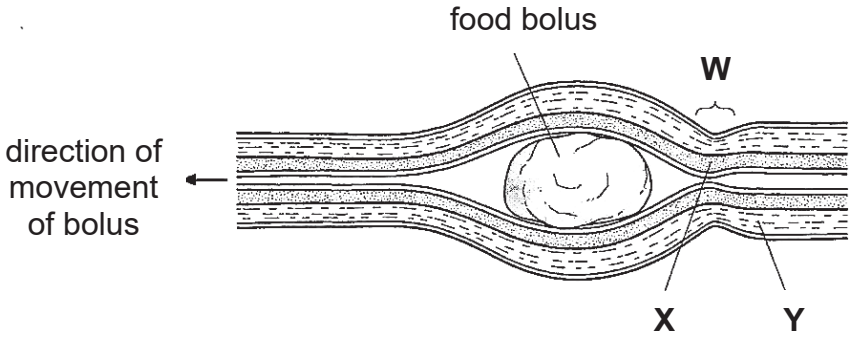
Which is/are valid conclusion(s) from these results?

1 The higher the concentration of inhibitor **X**, the lesser the amount of sucrose is broken down.
2 The production of glucose and fructose using inhibitor **Y** is higher than when inhibitor **Z** is used.
3 The production of glucose and fructose 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

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7 The diagram shows a food bolus moving down the oesophagus.



Which row identifies the muscles and their actions at region **W**?

	muscle **X**		muscle **Y**	
	muscle type	muscle action	muscle type	muscle action
A	circular	contracting	longitudinal	relaxing
B	circular	relaxing	longitudinal	contracting
C	longitudinal	contracting	circular	relaxing
D	longitudinal	relaxing	circular	contracting

8 A student carried out three food tests on two unknown samples as shown below.

contents	food test carried out after contents were mixed for 20 minutes		
	Benedict's test	biuret test	iodine test
2 cm^3 **X** and water	blue	blue	blue-black
5 cm^3 **X**, 2 cm^3 **Y** and 1 cm^3 sodium hydroxide solution	red precipitate	violet	blue-black

Which of the following represents **X** and **Y**?

	X	**Y**
A	starch	saliva
B	starch	pancreatic juice
C	maltose	pancreatic juice
D	maltose	intestinal juice

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9 The diagram shows the label from a bottle of gin.



What will happen, during the next few hours, after a person drinks a large volume of gin?

A Their judgement of distance will improve.

B Their muscle control will be reduced.

C Their reaction time will decrease.

D Their urine output will decrease.

10 A student investigates the effect of different colours of light on the rate of photosynthesis.

In three separate experiments, red, blue or green light was shone onto an aquatic plant. The number of oxygen bubbles produced by the plant was counted.

Each experiment was carried out three times and the average number of bubbles was calculated.

colour of light	average number of bubbles produced / minute
red	48
blue	37
green	12

What explains the results?

A Chlorophyll absorbs red and blue light more than green light.

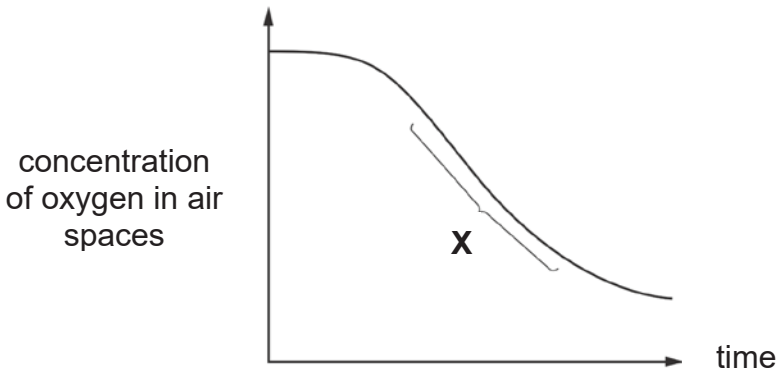
B Green light is absorbed by the water.

C Most of the green light is absorbed by the chlorophyll.

D Red light is used least in photosynthesis.

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11 The graph shows the concentration of oxygen in the air spaces of a green leaf of a plant during a 12-hour period.



Which statement about carbon dioxide in the air spaces during time **X** is correct?

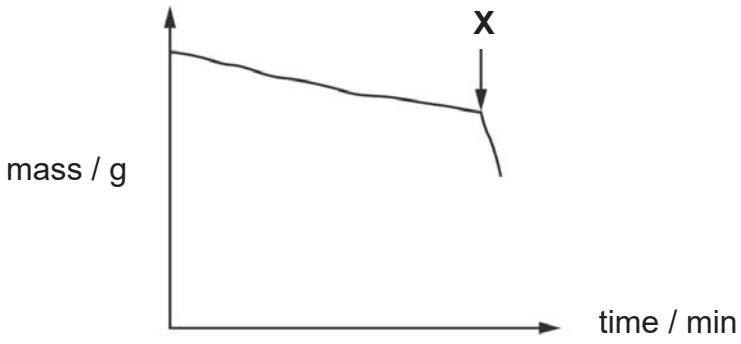
A Carbon dioxide is being produced because the rate of photosynthesis is greater than the rate of respiration.

B Carbon dioxide is being produced because the rate of respiration is greater than the rate of photosynthesis.

C Carbon dioxide is being used because the rate of photosynthesis is greater than the rate of respiration.

D Carbon dioxide is being used because the rate of respiration is greater than the rate of photosynthesis.

12 The graph shows the loss of mass in a potted plant due to transpiration.



What could have occurred at point **X** on the graph?

A A plastic bag was placed around the plant.

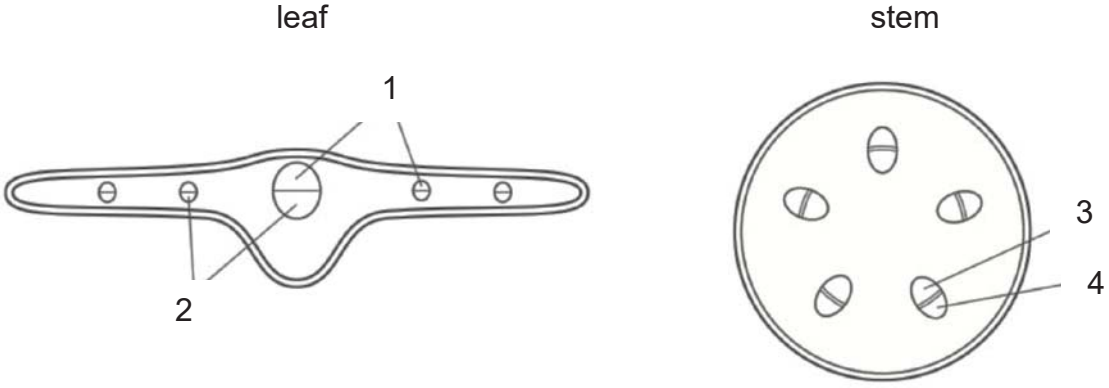
B The lower epidermis was sealed with petroleum jelly.

C The plant was placed into a dark cupboard.

D Warm moving air was blown over the plant.

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13 The diagrams show transverse sections of parts of a plant.



Which labelled structures mainly transport amino acids and mineral ions?

	amino acids	mineral ions
A	1 and 3	2 and 4
B	1 and 4	2 and 3
C	2 and 3	1 and 4
D	2 and 4	1 and 3

14 Below are correct statements comparing blood and tissue fluid in a capillary bed.

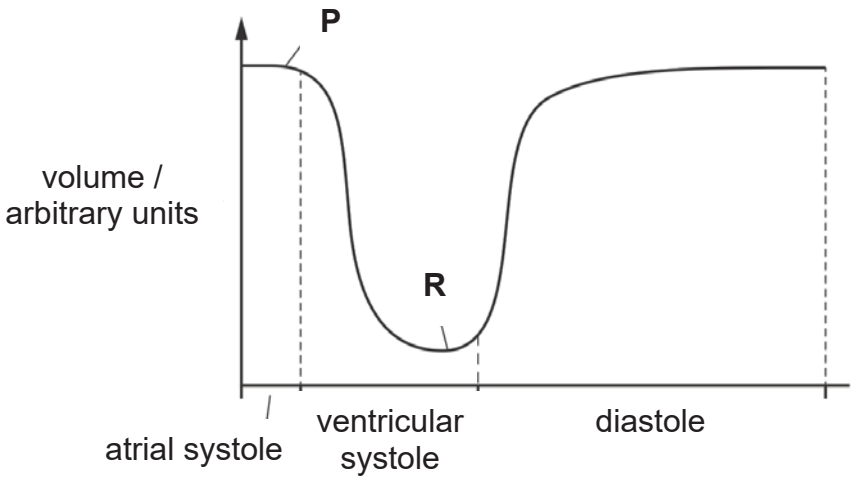
- **W** lacks large plasma proteins and red blood cells.
- **X** is at a lower pressure than **Y** and contains red blood cells and large plasma proteins.
- **Y** is at a higher pressure than **W** and contains red blood cells and large plasma proteins.

Which correctly identifies **W**, **X**, and **Y**?

	W	**X**	**Y**
A	blood entering capillary	tissue fluid	blood leaving capillary
B	blood leaving capillary	blood entering capillary	tissue fluid
C	tissue fluid	blood entering capillary	blood leaving capillary
D	tissue fluid	blood leaving capillary	blood entering capillary

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15 The graph shows changes in the volume of the ventricles during the cardiac cycle.



Which valves open and close at **P** and **R**?

	atrioventricular valve at **P**	semilunar valve at **R**
A	closes	closes
B	closes	opens
C	opens	closes
D	opens	opens

16 The table shows the blood test results of two students, **X**, and **Y** for blood transfusion.

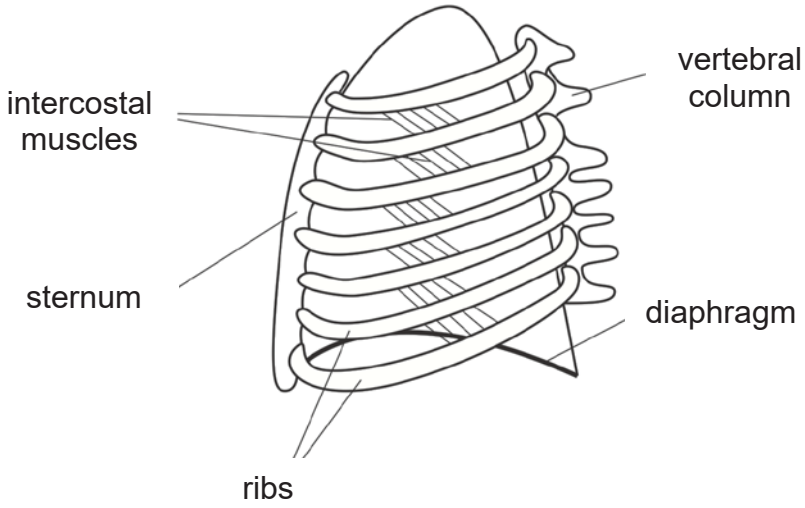
		donor	
		X	**Y**
recipient	**X**	no agglutination	agglutination
	Y	no agglutination	no agglutination

Which of the following may be the blood types of students **X** and **Y**?

	student **X**	student **Y**
A	A	AB
B	A	O
C	B	B
D	AB	O

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17 The diagram shows the rib cage and some of the muscles involved in breathing as seen from the side.



What happens when the intercostal muscles shown in the diagram contract?

A The diaphragm moves down.

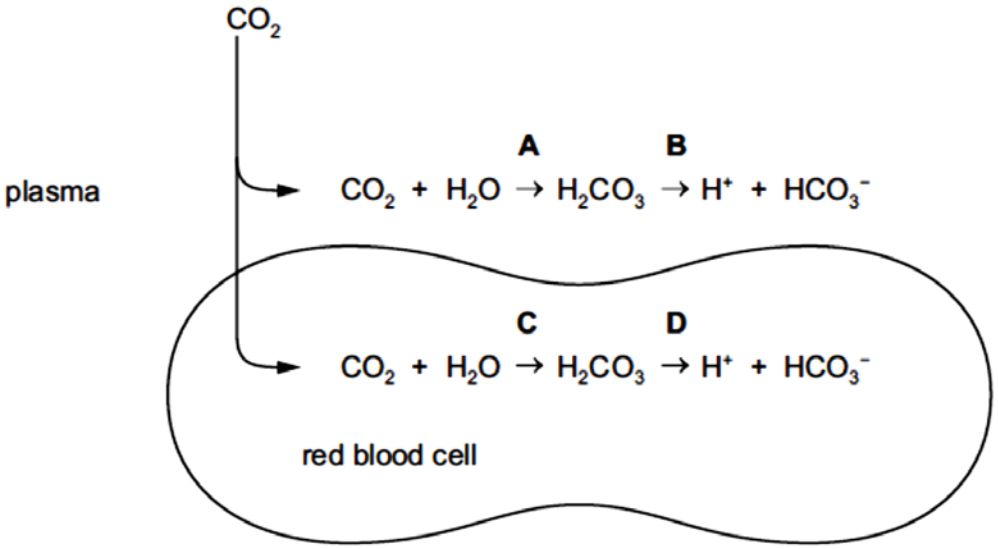
B The lungs inflate.

C The pressure inside the lungs decreases.

D The ribs move down.

18 The diagram shows some of the reactions of carbon dioxide when it enters the blood from cells in a metabolically active tissue.

Which reaction is catalysed by the enzyme carbonic anhydrase?



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19 Which of the effects listed occur as a result of inhaling both carbon monoxide and nicotine from cigarette smoke?

1 increased heart rate
2 increased risk of cardiovascular disease
3 increased risk of emphysema
4 increased risk of lung cancer

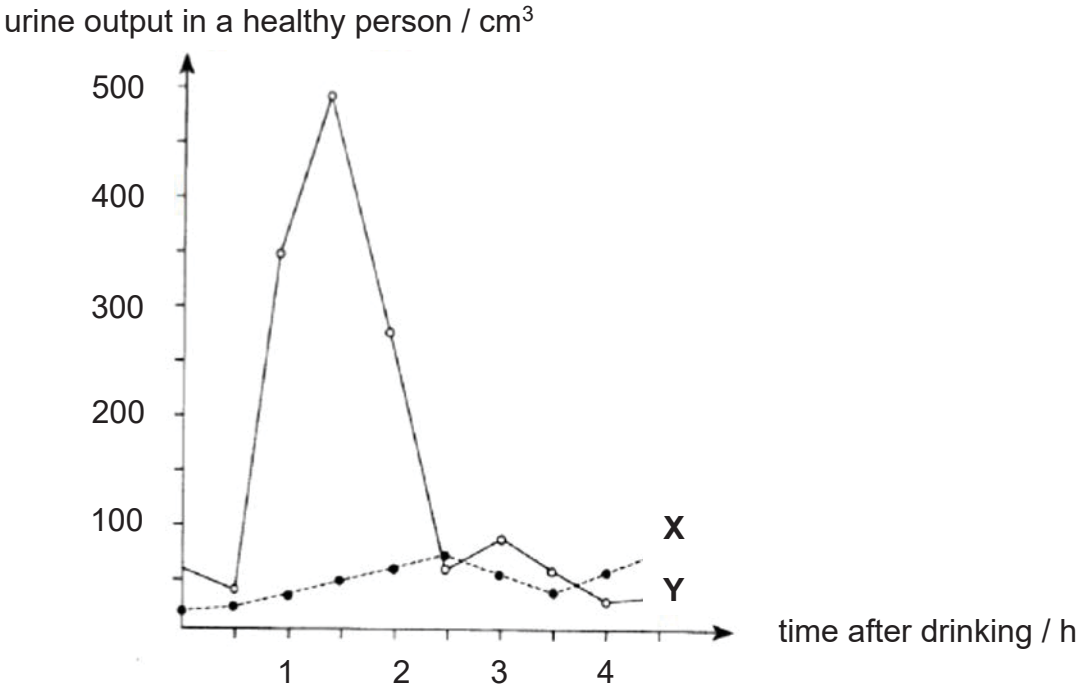
A 1 and 2

B 3 and 4

C 1, 2 and 3

D 2, 3 and 4

20 The graph shows the effect of drinking 1 litre of water and 1 litre of concentrated salt solution on the urine output in a healthy person.

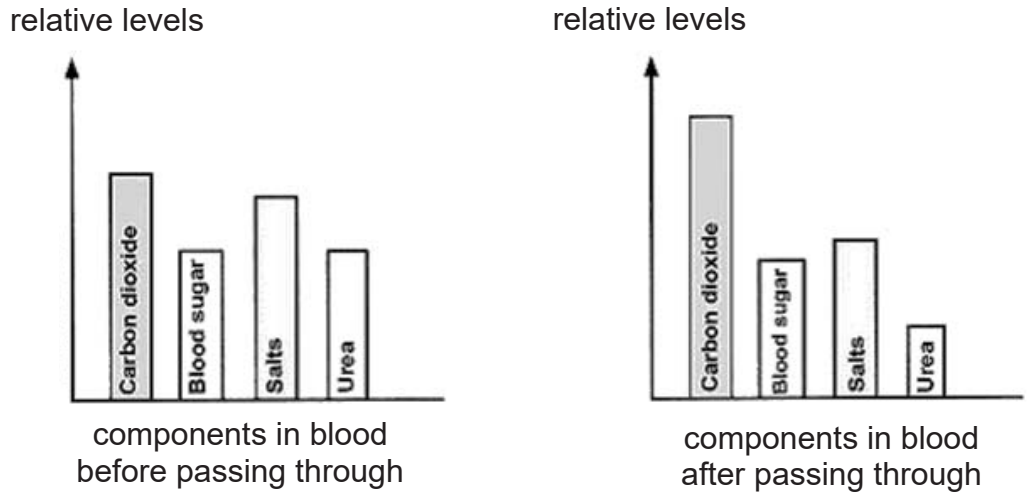


Which correctly identifies each line and the explanation for it?

	drinking 1 litre of water		drinking 1 litre of concentrated salt solution	
	line	explanation	line	explanation
A	X	less ADH to be produced	Y	more ADH to be produced
B	X	more ADH to be produced	Y	less ADH to be produced
C	Y	less ADH to be produced	X	more ADH to be produced
D	Y	more ADH to be produced	X	less ADH to be produced

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21 The bar charts show the relative levels of some substances in the blood before and after passing through a certain organ in the human body.



Which organ has the blood passed through?

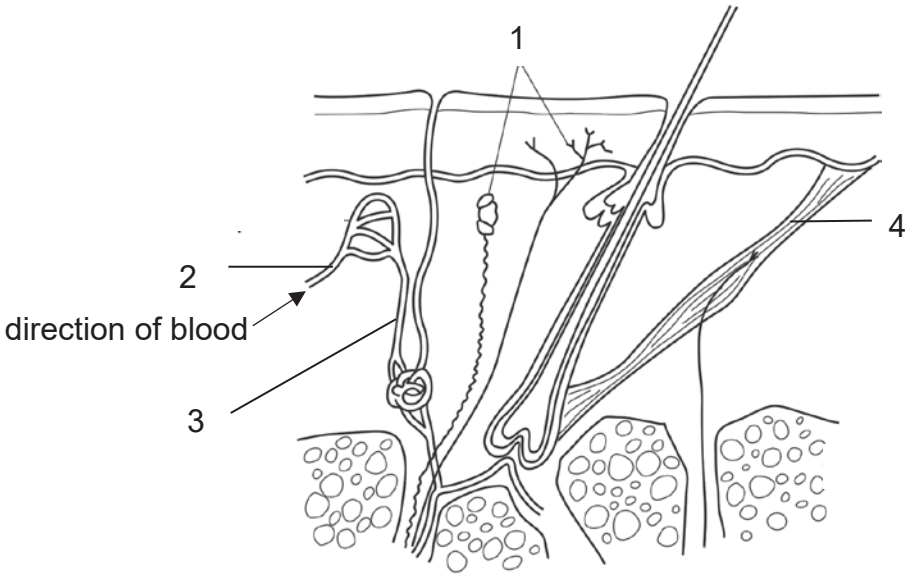
A kidney

B liver

C lungs

D small intestine

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

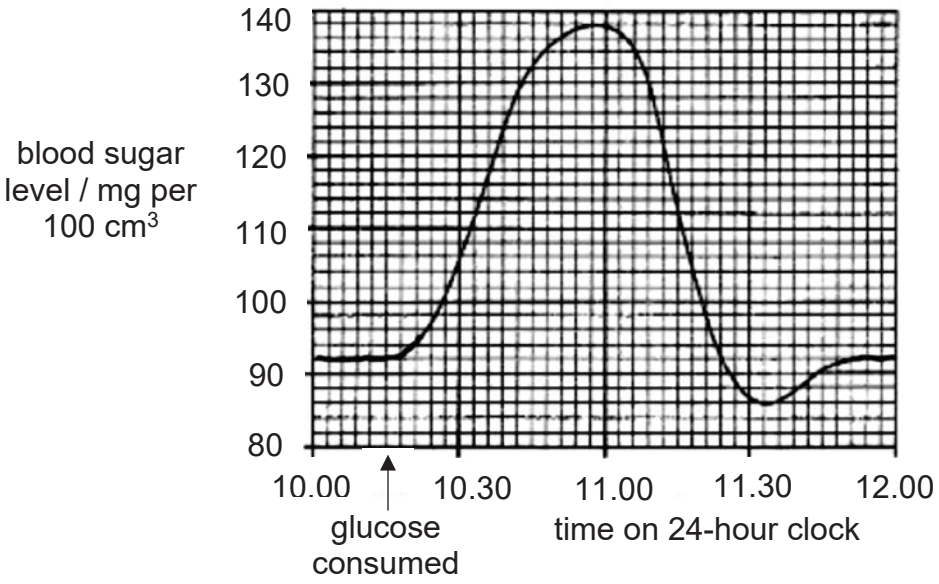


Which structures contain muscles that relax when the surrounding temperature is too hot?

A 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

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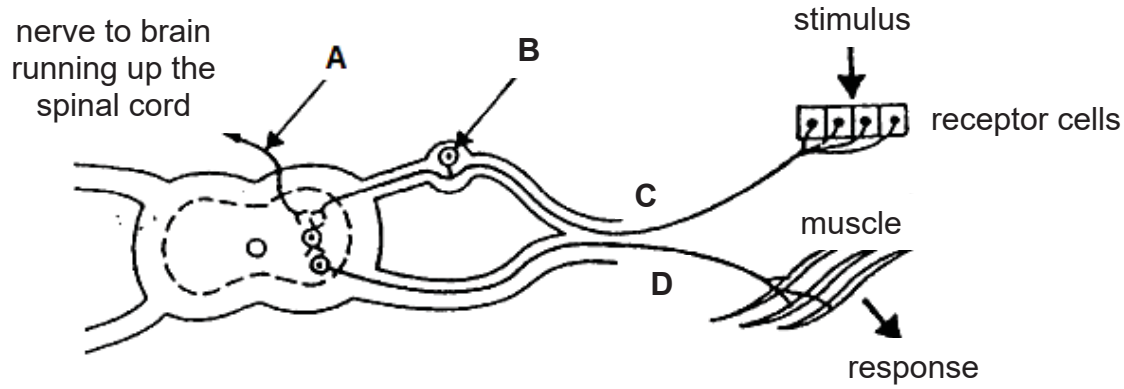
23 The graph shows the blood sugar level of a person who has consumed 50 g of glucose at the time indicated.



At which time of the two-hour period would the secretion of insulin and glucagon increase?

	increased amount of insulin	increased amount of glucagon
A	10.30	11.00
B	10.30	11.30
C	11.00	10.30
D	11.30	10.30

24 The nerve pathway of a simple reflex arc is shown below.

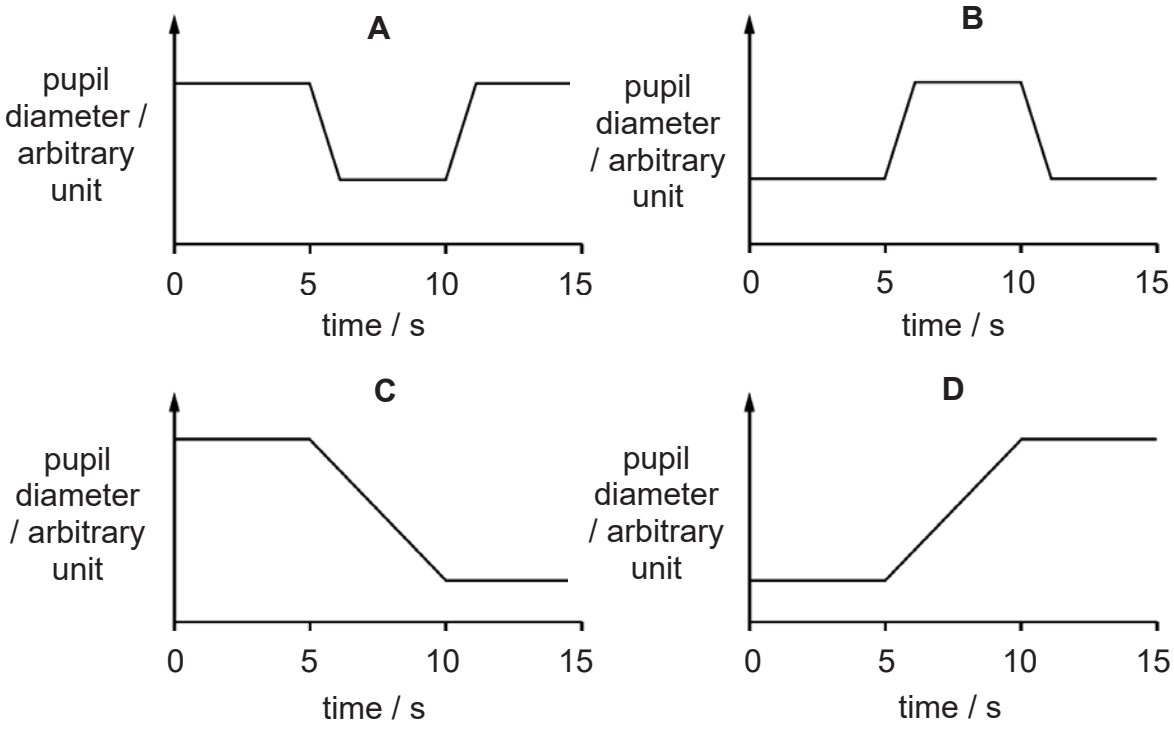


Where should a cut be made so that a response is enabled without sensation of pain?

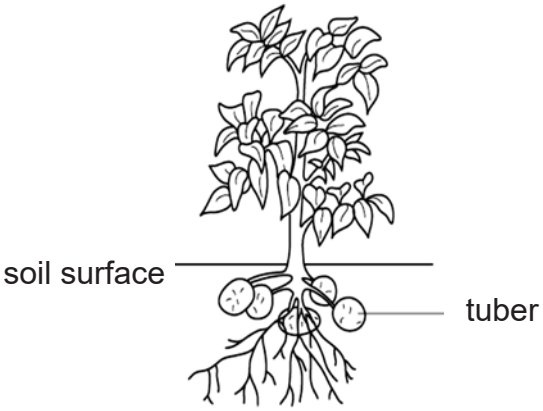
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25 A person is sitting in a brightly lit room. After five seconds, a light is turned off. Five seconds after that, the light is turned on again.

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



26 The diagram shows a potato plant reproducing asexually by tubers.



Four observations were made about the potato plant.

1 There is one parent plant.
2 The tubers are attached to the parent.
3 The tubers are genetically identical to the parent.
4 The tubers store food.

Which of these observations describe asexual reproduction?

A 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

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27 The table below shows information about the flowers of three different plants.

flower characteristics	plant **A**	plant **B**	plant **C**
petal colour	white	purple	bright yellow
aroma	none	pungent smell	sweet smell
petal size	0.3 cm	10.0 cm	4.0 cm
nectar volume	none	medium amount	large amount

Which inference is valid concerning the method of pollination for plants **A**, **B** and **C**?

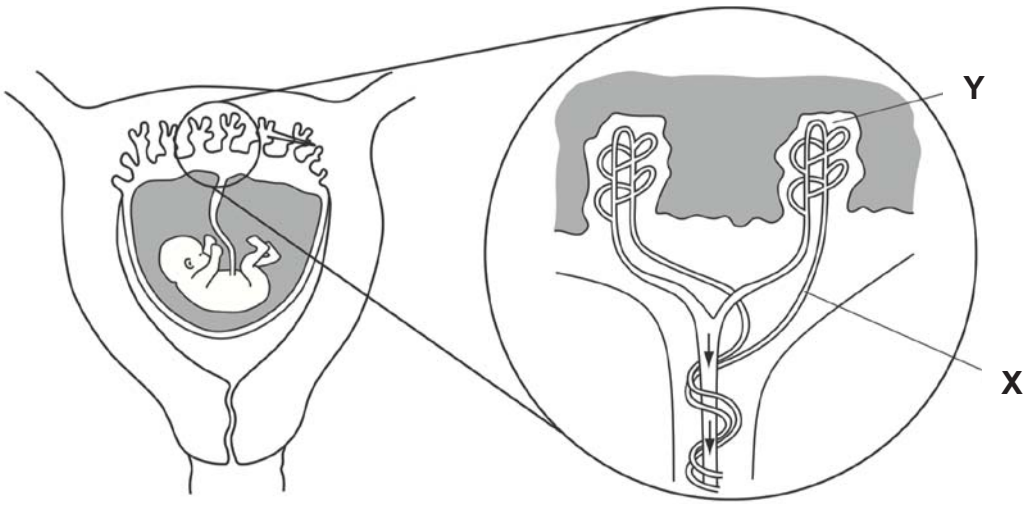
A All three plants are wind pollinated.

B All three plants are insect pollinated.

C Plant **A** is wind pollinated but plants **B** and **C** are insect pollinated.

D Plants **A** and **B** are insect pollinated but plant **C** is wind pollinated.

28 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

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29 The diagram shows the menstrual cycle of a woman in the month of September.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

key

= ovulation

= menstruation

Why fertilisation would **not** take place if sperms are released into the vagina on the 8th September?

A Sperms are washed out of the female uterus by the menstrual flow.

B Sperms can survive in the female reproductive system for only 3 or 4 days.

C Sperms must be released after ovulation for fertilisation to take place.

D The uterus lining is washed out of the female body during menstruation.

30 A student examined the cells in the growing region of an onion root and obtained the data below.

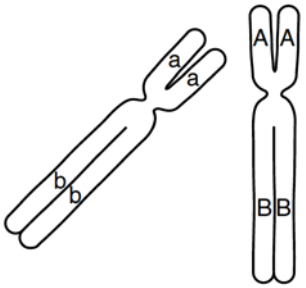
stage	number of cells
interphase	886
prophase	73
metaphase	16
anaphase	14
telophase	11

What percentage of cells in mitosis contains chromosomes that appear as two chromatids?

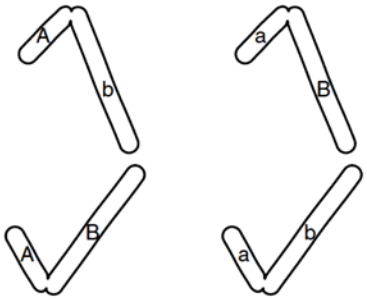
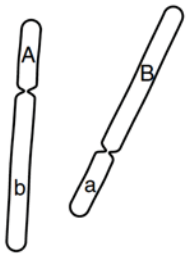
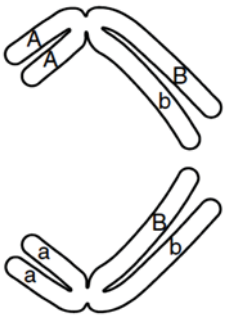
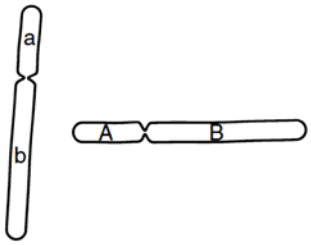
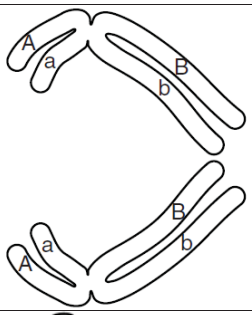
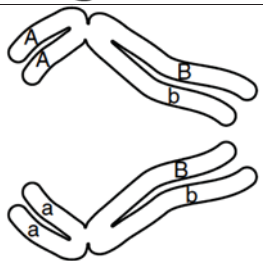
A 97.5 % **B** 95.9 % **C** 78.1 % **D** 8.9 %

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31 The diagram shows two homologous chromosomes in early prophase I of meiosis in an animal cell. Two genes, **A**/**a** and **B**/**b**, whose loci occur on the homologous chromosomes are also shown.



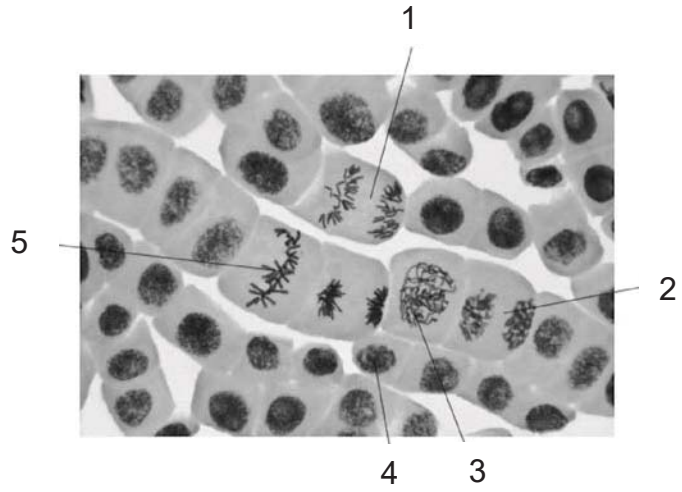
Which row of diagrams is a possible representation of these chromosomes as they progress from anaphase I to prophase II?

	anaphase I	prophase II
A		
B		
C		
D		

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32 The photomicrograph shows cells in different stages of mitosis.

In which order do these stages occur?



A 3 → 5 → 2 → 1 → 4

B 3 → 5 → 1 → 2 → 4

C 4 → 3 → 5 → 1 → 2

D 4 → 5 → 1 → 2 → 3

33 Which correctly shows situations in which DNA and RNA are both involved?

	replication	transcription	translation
A	√	√	✕
B	√	✕	√
C	✕	✕	√
D	✕	√	✕

key

√ involved

✕ not involved

34 Genetic engineering can be used to introduce new characteristics into animals and plants.

Which characteristic is **not** likely to be introduced into a cereal crop plant by genetic engineers?

A resistance to bacterial diseases

B resistance to fungal diseases

C resistance to insecticides

D resistance to viral diseases

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35 The table shows the percentage of nitrogenous bases in four samples of nucleic acids.

Which base is adenine?

sample	percentage of nitrogenous bases / %				
	A	**B**	**C**	**D**	uracil
1	19	31	31	19	nil
2	26	24	24	26	nil
3	25	25	nil	25	25
4	18	32	32	18	nil

36 The family tree shows the inheritance of the ability to smell flowers called freesias. The allele for the ability to smell freesias is dominant.

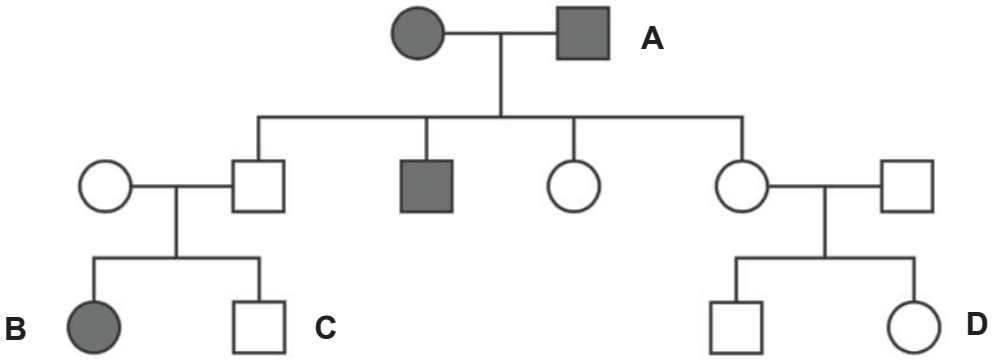
key

female able to smell freesias

female unable to smell freesias

male able to smell freesias

male unable to smell freesias



Which individual's symbol is **not** correct?

37 One gene has two codominant alleles, A^E and A^F and one recessive allele, A^G.

How many different genotypes and phenotypes are possible?

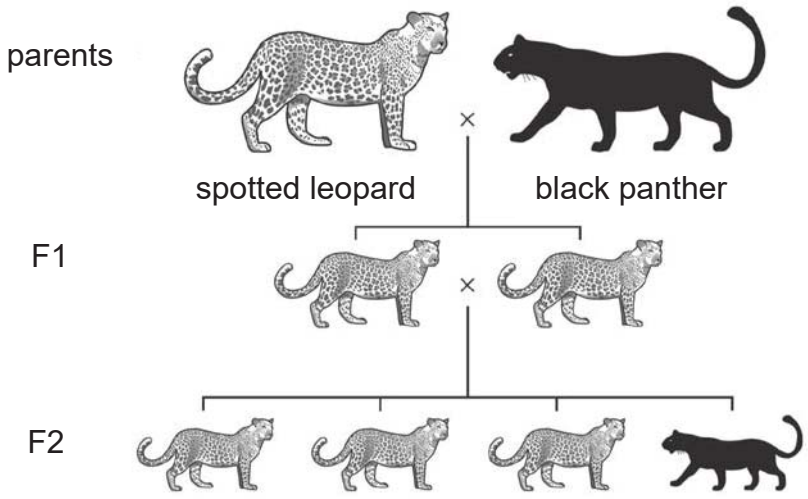
	genotypes	phenotypes
A	3	3
B	4	6
C	6	4
D	6	6

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38 In the leopard, coat colour is controlled by a single gene with two alleles, H and h. There are two varieties - black panthers and spotted leopards.

The diagram shows a cross between a spotted leopard and a black panther.

All the offspring in the F1 generation were spotted leopards. The results of a cross between two animals of the F1 generation are also shown.

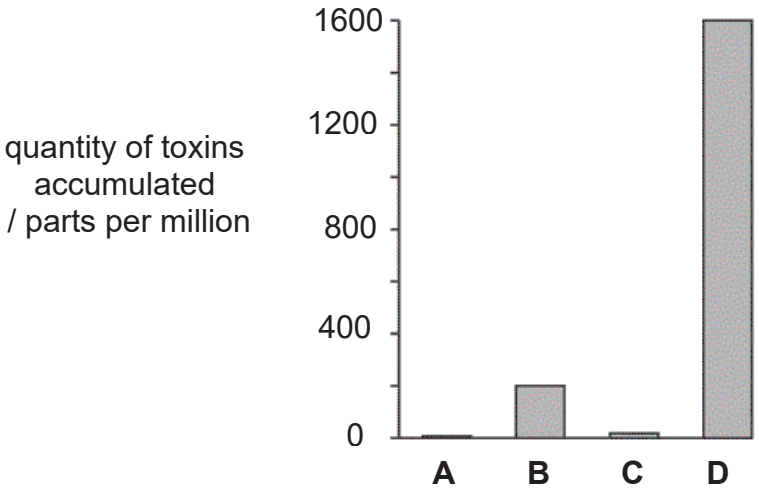


What are the genotypes of the original two parents?

	spotted leopard	black panther
A	HH	hh
B	HH	Hh
C	Hh	hh
D	hh	HH

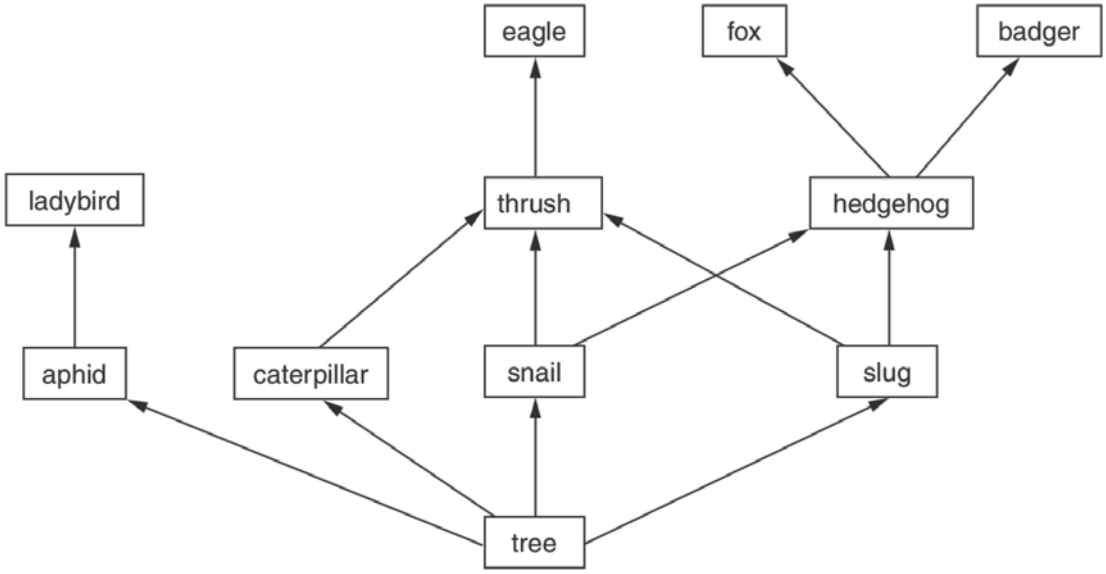
39 The graph shows the quantities of toxins that accumulate in four populations, each at different trophic levels in a food chain.

Which is most likely to be herbivores?

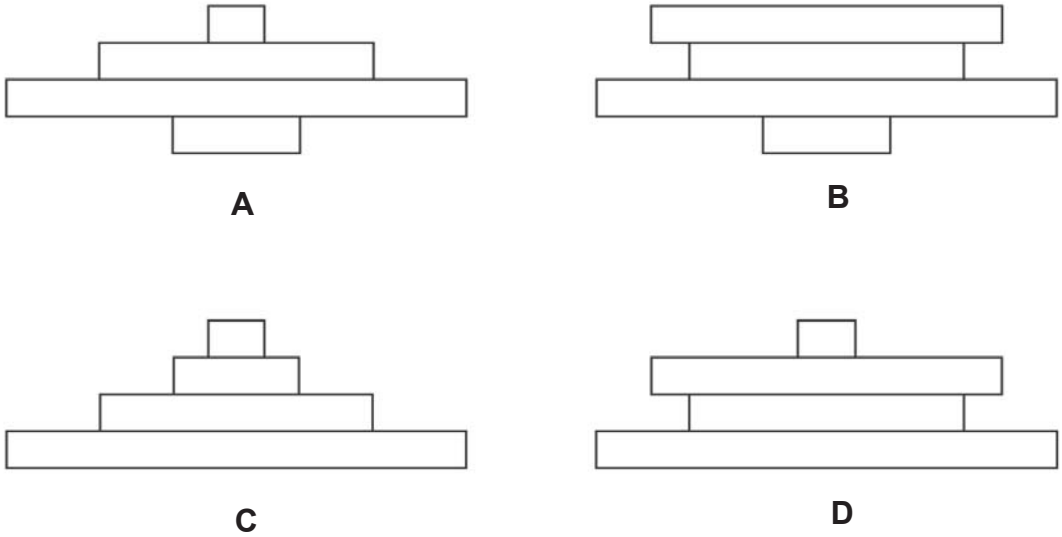


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40 The diagram shows part of a food web.



Which is a pyramid of numbers based on this food web?



A

B

C

D

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Candidate Name:	Class	Index No.
	4E1	

FUHUA SECONDARY SCHOOL

Secondary Four Express

Preliminary Examination 2018

4E

Fuhua Secondary Fuhua Secondary Fuhua Secondary Fuhua Secondary Fuhua Secondary Fuhua Secondary Fuhua Secondary Fuhua Secondary Fuhua Secondary
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BIOLOGY 6093/02

21 Aug 2018
1125 - 1310
1 hour 45 minutes

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on 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** questions.
Write your answers in the spaces provided on the Question Paper.
The last question is in the form of Either/ Or.

You are advised to spend no longer than 1 hour on Section A and no longer than 45 minutes on Section B.

Electronic calculator may be used.

The number of marks is given in brackets [ ] at the end of each question or part question.

PARENT'S SIGNATURE	FOR EXAMINER'S USE		
	50	30	80

This question paper consists of 23 printed pages including this page.

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

1 Fig. 1.1 shows part of the flowering head of a tree.

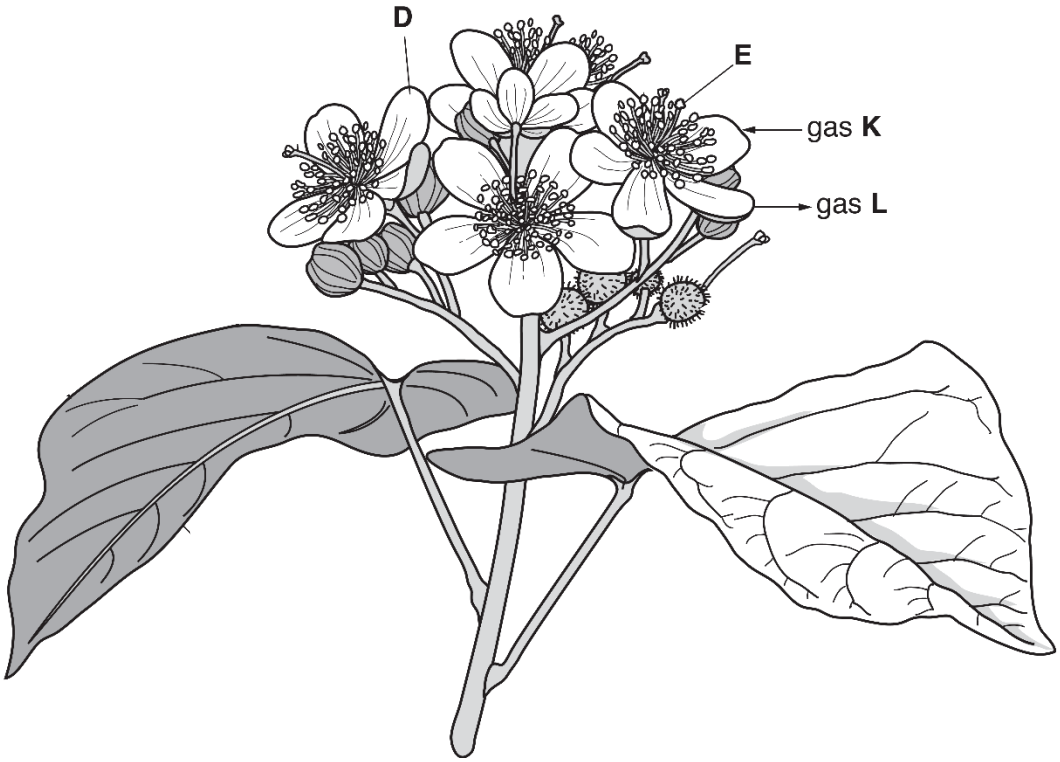


Fig. 1.1

Structure **D** contains stomata similar to those found in the leaves.
K and **L** represent gases that pass into and out of the leaves and flowers during daylight hours.

(a) The flowers are very pale pink in colour. Suggest the identity of gases **K** and **L**. Explain your answer.

K ..... **L** .....

explanation .....

.....

.....

.....

..... [4]

(b) State the function of structure **E**.

..... [1]

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(c) Fig. 1.2 shows the effect of the concentration of carbon dioxide on the rate of photosynthesis in apple plants at 20 ^{0}C.

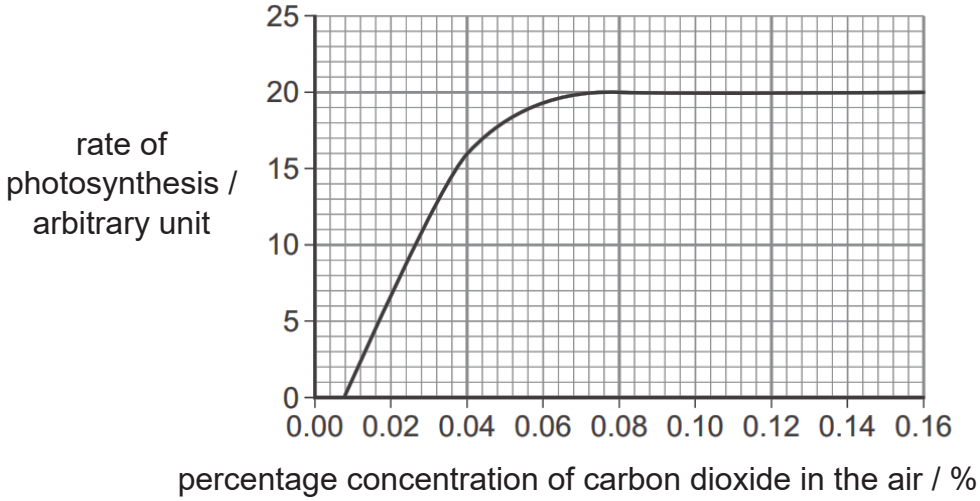


Fig. 1.2

(i) A farmer grows apple plants in a large greenhouse.

Calculate the percentage change in the rate of photosynthesis of the apple plant when the carbon dioxide concentration is decreased from 0.08 % to 0.04 % in the greenhouse.

percentage change = ... % [1]

(ii) Explain why the farmer would **not** use a concentration of carbon dioxide higher than 0.08 %.

.....

.....

.....

..... [2]

[Total: 8]

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2 Fig. 2.1 shows the life cycle of *C. elegans*.
The diploid number of this species is 12.

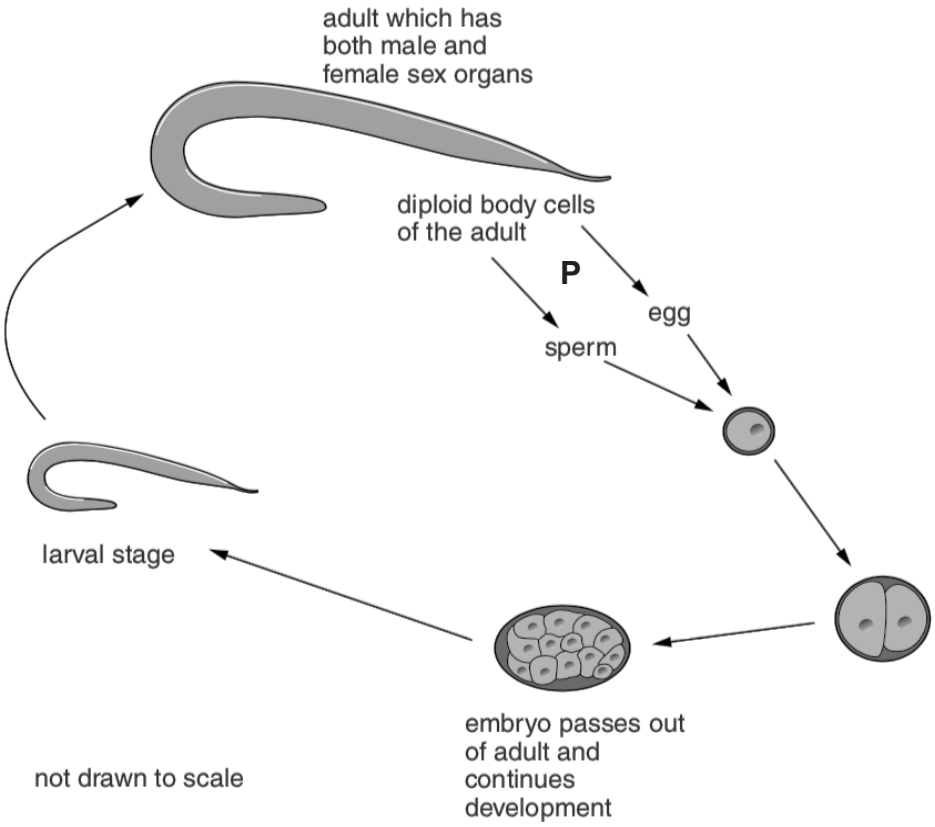


Fig. 2.1

(a) Define the term *diploid.*

.....

..... [1]

(b) State the number of chromosomes found in each cell of the embryo.

..... [1]

(c) Suggest why there is very little genetic variation in the offspring of the adult shown in Fig. 2.1.

.....

.....

.....

.....

..... [2]

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(d) **(i)** Identify the type of cell division that occurs at **P**.

.....[1]

(ii) Explain why the cell division identified in **(d)(i)** occurs at **P**.

.....

.....

.....

.....[2]

[Total: 7]

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3 Two common genetic conditions, glaucoma and albinism, affect the human eye.

(a) Fig. 3.1 shows a drawing of a section through a human eye.

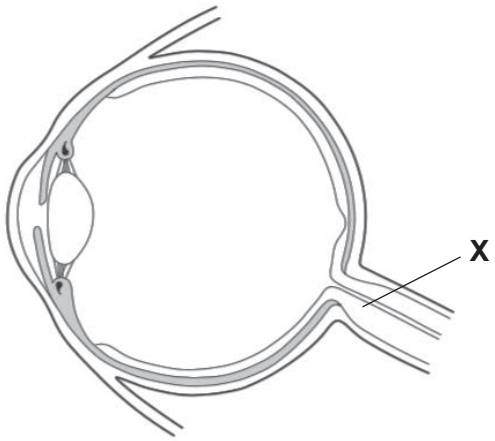


Fig. 3.1

(i) Glaucoma is caused by a build-up of pressure within the eye which may damage structure **X** as shown in Fig. 3.1.

Suggest how a person with untreated long term glaucoma may have vision loss and absence of pupil reflex.

.....

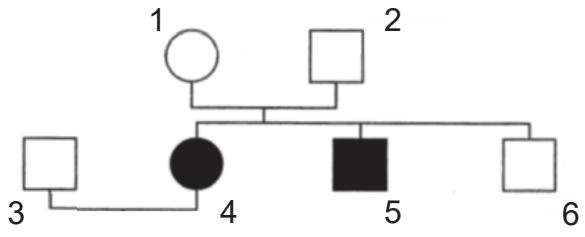
.....

.....

.....

..... [3]

Fig. 3.2 shows part of a family tree in which some of the people have the type of glaucoma that is caused by the recessive allele, **g**.



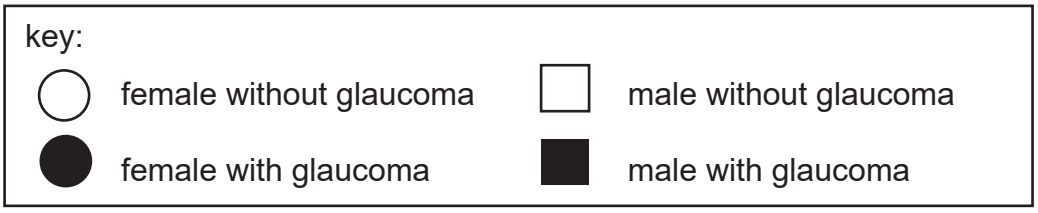


Fig. 3.2

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(ii) With reference to Fig. 3.2, state **and** explain the genotype of individual **1**.

.....

.....

.....

.....

..... [3]

(iii) State the probability of a male child with glaucoma from parents who are both heterozygous.

..... [1]

(b) Tyrosinase is an enzyme that functions in the production of dark brown pigment, melanin, normally present in the iris of eyes. The tyrosinase gene can be found on human chromosome number 11.

Fig. 3.3 shows how the colour of iris varies according to the distribution of relative amount of melanin present in iris.

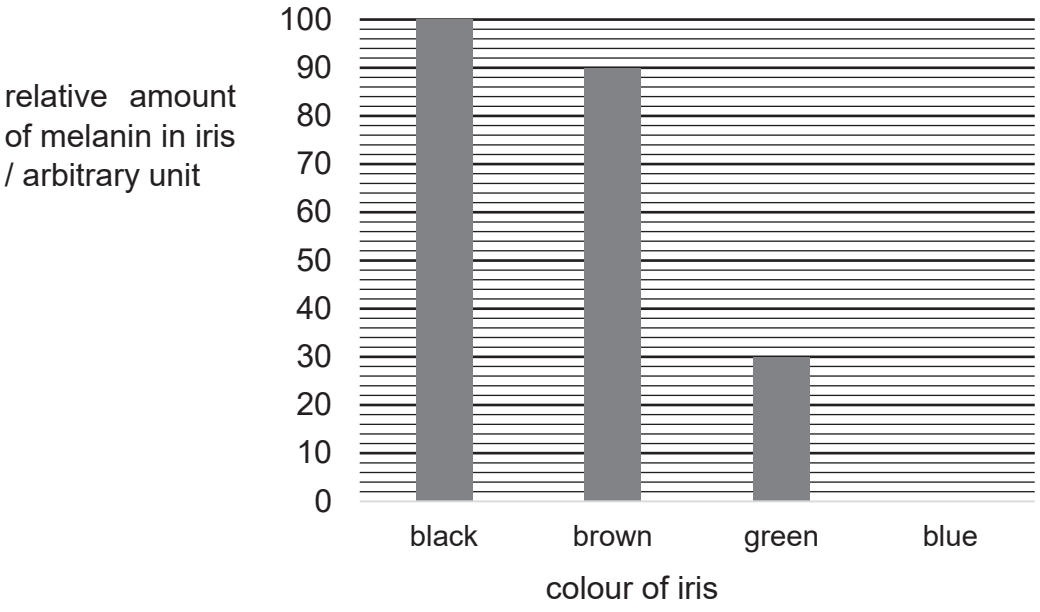


Fig. 3.3

The role of tyrosine in melanin production is shown below:

$$\text{tyrosine} \xrightarrow{\text{tyrosinase}} \text{dihydroxyphenylalanine} \longrightarrow \text{melanin}$$

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(i) Explain how a gene mutation on chromosome number 11 may result in formation of blue iris.

.....

.....

.....

..... [2]

(ii) Using the information given in the question, state **and** explain if iris colour is a continuous or discontinuous variation.

.....

..... [1]

[Total: 10]

4 Kidneys are important body organs involved in excretion.

(a) Define the term *excretion*.

.....

.....

..... [1]

Three samples of urine were obtained from different people to check if their kidneys are functioning normally. Benedict's test and biuret test were performed using the three urine samples.

Table 4.1 shows the results.

Table 4.1

sample	Benedict's test	biuret test
A	green precipitate	colourless solution
B	blue solution	colourless solution
C	blue solution	violet colouration

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(b) Using the information from Table 4.1, explain which sample could be from a person with

(i) high blood pressure,

.....

.....

..... [2]

(ii) diabetes.

.....

.....

..... [2]

(c) A person with kidney damage needs to undergo the process of dialysis to take place several times each week.

(i) State one way in which blood returning from the dialysis machine will differ from blood leaving the body to enter the dialysis machine.

.....

..... [1]

(ii) Suggest **and** explain how the efficiency of dialysis is affected if the dialysis fluid contains a small amount of urea.

.....

.....

.....

..... [2]

[Total: 8]

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5 Fig. 5.1 shows a carbon cycle with the arrows representing the various processes happening in the cycle.

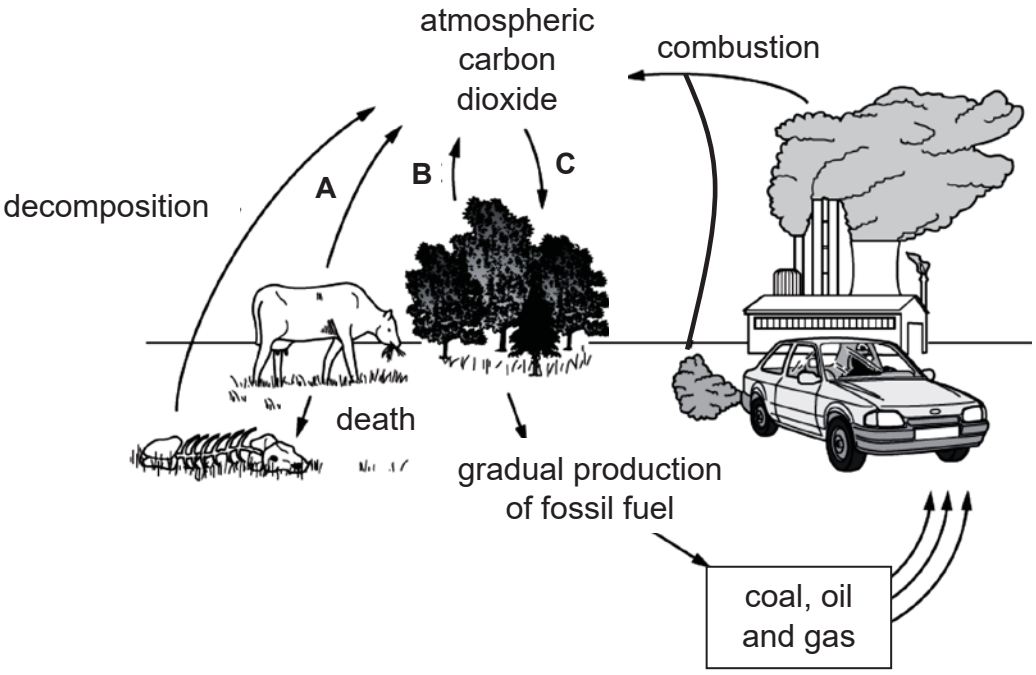


Fig. 5.1

Table 5.1 shows the amount of carbon transferred in the various processes of the cycle per year.

Table 5.1

processes	flow of carbon in gigatons of carbon per year
decomposition	11
A	90
B	110
C	140
combustion	8
fossil fuel formation	15

(a) Arrows **A** and **B** represent the same process.
State the equation, in symbols, to represent this process.

.....[1]

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(b) Using the information in Fig. 5.1 and Table 5.1, explain how forests can act as a carbon sink.

.....

.....

.....

.....

..... [3]

(c) Fig. 5.2 shows the direction of flow of a river near a fertiliser factory. The concentration of dissolved oxygen and nitrate of river water taken from site **A** to site **B** were measured as shown in Fig. 5.3.

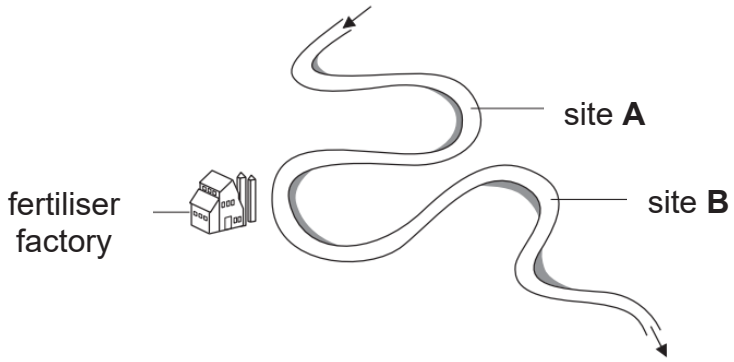


Fig. 5.2

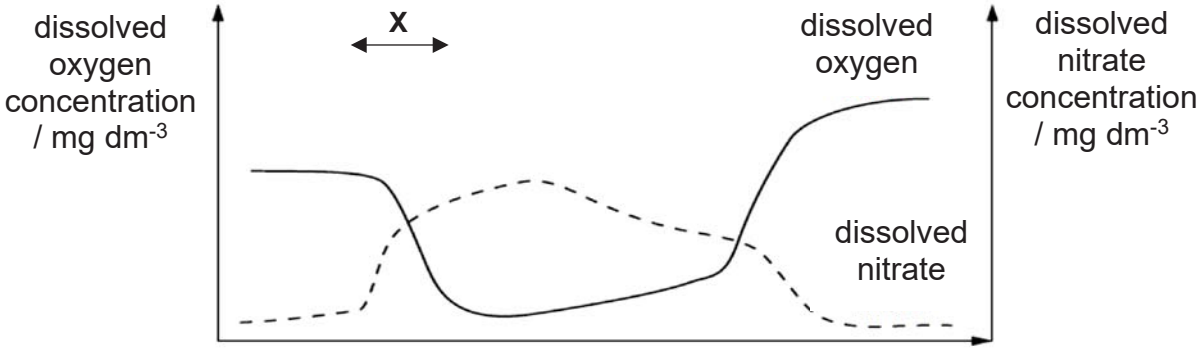


Fig. 5.3

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With reference to Fig. 5.2 and Fig. 5.3, explain the appearance of large numbers of dead fish in the region marked **X** in Fig. 5.3.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 7]

6 Fig. 6.1 shows an organ, **X**, and its associated blood vessels **P**, **Q** and **R**.

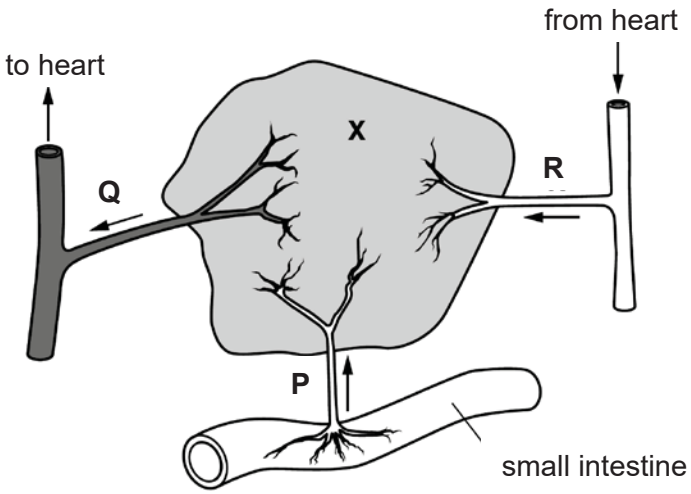


Fig. 6.1

Organ **X** is involved in the following processes:
- the metabolism of amino acids,
- the breakdown of chemical substances, including alcohol.

(a) Name blood vessel **R**.

..... [1]

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(b) Samples of blood of a healthy person were taken from blood vessels **P** and **Q** to determine the concentration of blood glucose after a meal.

Fig. 6.2 shows the concentration of glucose in the two blood vessels 1 hour after the meal.

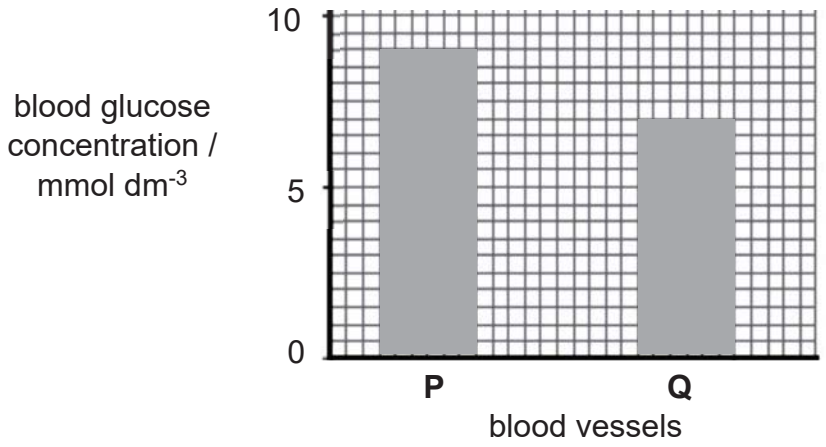


Fig. 6.2

(i) Describe **and** explain the difference in the blood glucose concentration of the blood samples taken from blood vessels, **P** and **Q**.

.....

.....

.....

..... [2]

(ii) State the blood glucose concentration of blood sample taken from blood vessel **Q**, 6 hours after the meal.

..... [1]

[Total: 4]

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7 Fig. 7.1 shows the core body temperature of a cyclist before, during and after a race.

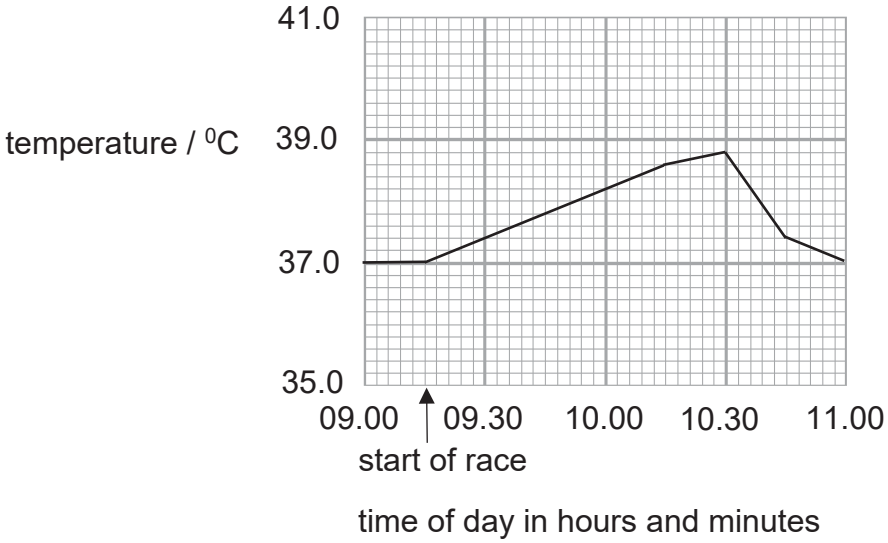


Fig. 7.1

(a) Name the process by which the core body temperature returns to a set point of 37.0 ^{0}C is achieved.

.....[1]

(b) Explain how sweat glands assist in the control of the core body temperature from 09.15 to 10.30.

.....

.....

.....

.....

.....[3]

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(c) Plants transpire while humans sweat to prevent overheating.
An investigation on transpiration was carried out at four different humidity levels as shown in Fig. 7.2. All other conditions were kept constant.

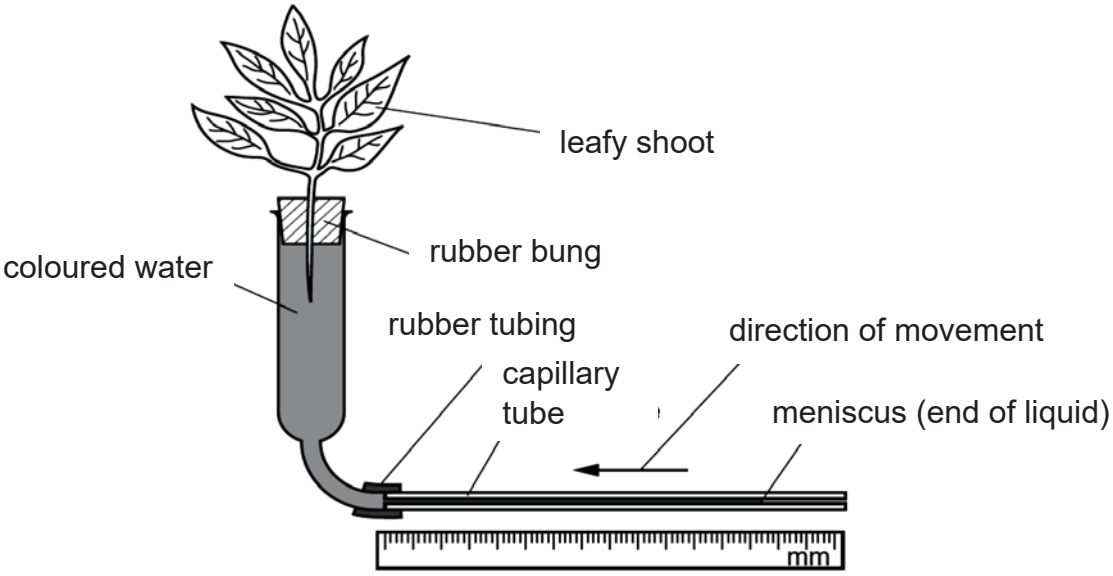


Fig. 7.2

The distance moved by the meniscus in five minutes at each humidity level is recorded and shown in Table 7.1.

Table 7.1

relative humidity	distance moved by meniscus in five minutes / mm
1 (least)	53
2	44
3	37
4 (most)	32

(i) State one conclusion that can be drawn from the results in Table 7.1 about the effect of humidity on the rate of transpiration.

.....

..... [1]

(ii) State one other environmental change that can result in the same outcome on the rate of transpiration as the increase in relative humidity.

..... [1]

[Total: 6]

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Section B: Free-Response Questions [30 marks]

Answer all the questions in this Section in the spaces provided.
The last question is in the form of Either/Or.

8 Table 8.1 shows data for the percentage of genetically modified (GM) crops such as soy bean and wheat grown in the USA from 1996 to 2014.

Table 8.1

year	percentage of GM crops / %	
	soy bean	wheat
1996	7	3
2000	34	7
2004	65	20
2008	80	35
2012	83	55
2014	84	68

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(a) On Fig. 8.1, draw a line graph to show how the percentage of each GM crop shown in Table 8.1 changes from 1996 to 2014.

Label the graphs drawn for each GM crop clearly.

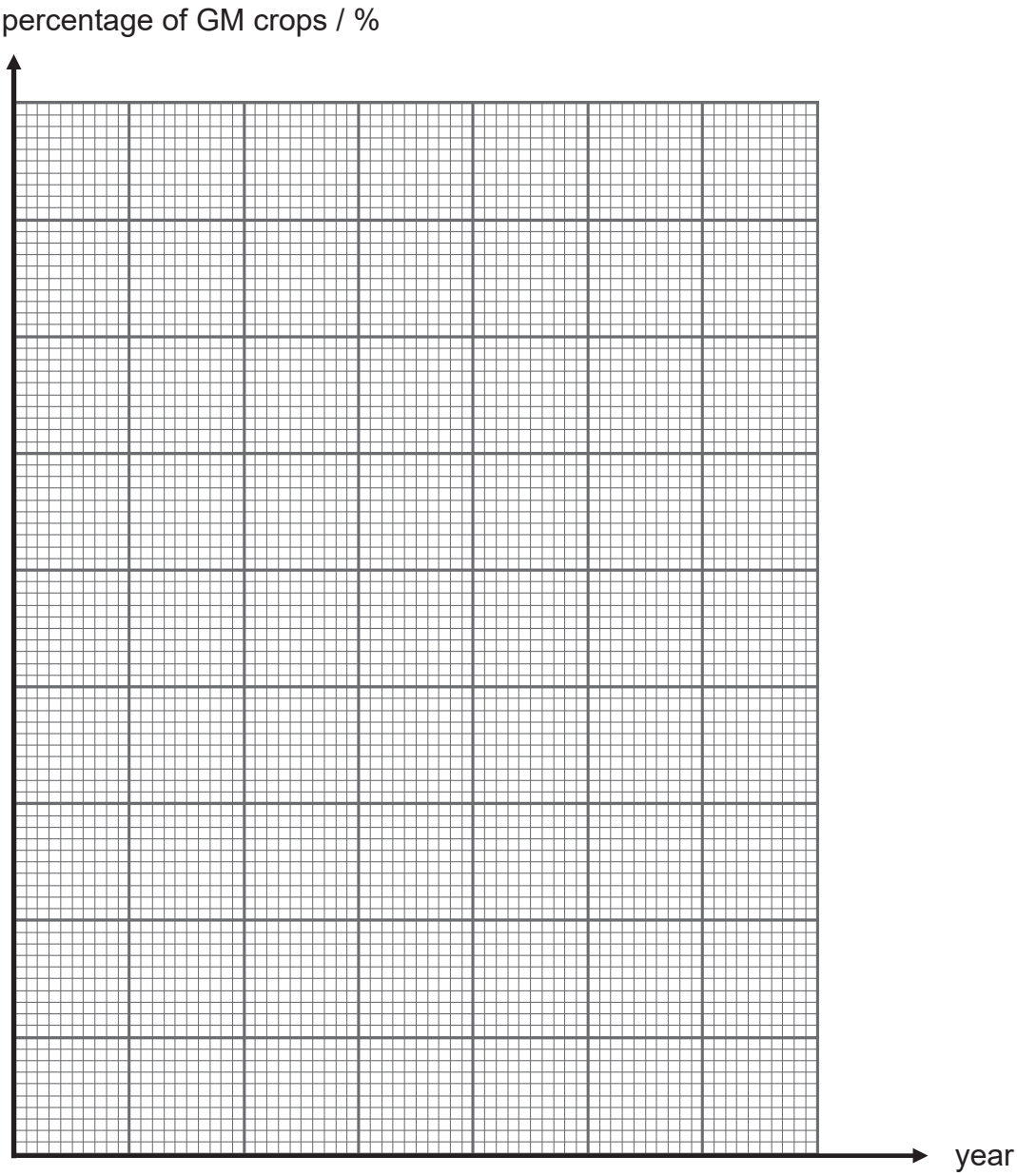


Fig. 8.1

[4]

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(b) With reference to the graph drawn in **(a)**, compare the changes in the GM soy bean and wheat crops grown from 1996 to 2014.

[3]

(c) Fig. 8.2 shows two possible uses of the same area of land to produce food.

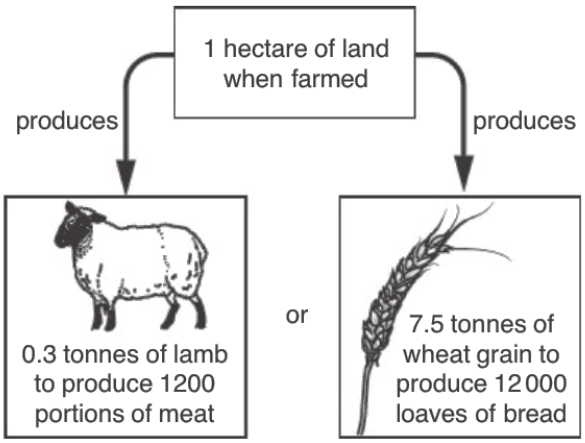


Fig. 8.2

Use the information in Fig. 8.2 and your own knowledge, explain why it would be more efficient use of the land to grow wheat as a food source for humans, as compared to rearing lambs.

[4]

[Total: 11]

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9 **(a)** Respiration releases energy. Some energy is used for greater muscle contraction during vigorous exercise.

Outline **two** other uses of energy in the human body.

1 .....

.....

2 .....

..... [2]

(b) Blood samples were taken from a person's finger before, during and after vigorous exercise and tested for lactic acid.

The results of the test for lactic acid are shown in Fig. 9.1.

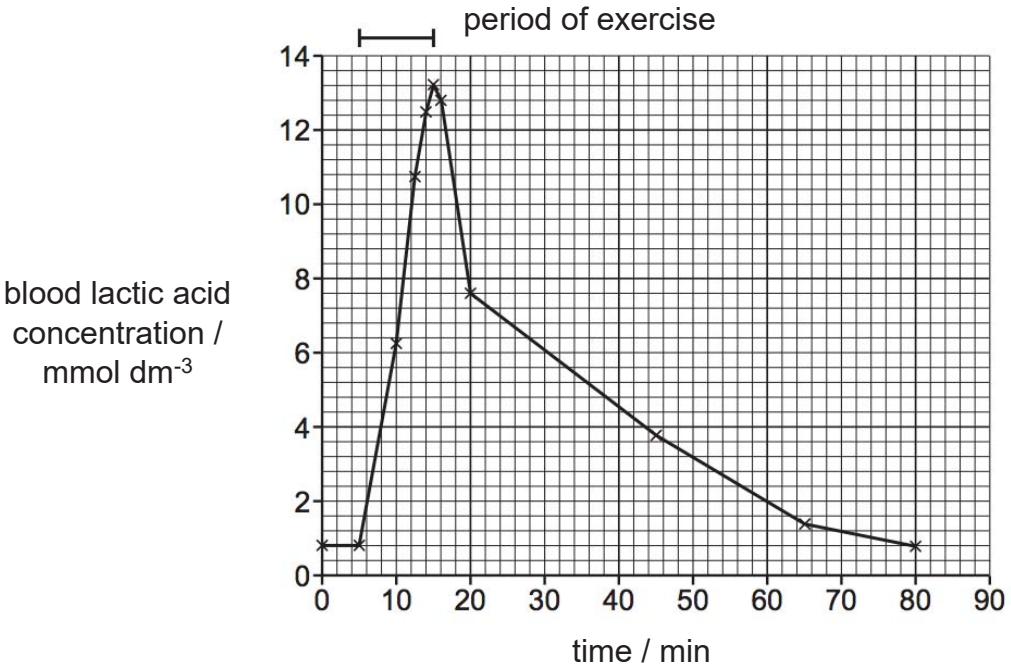


Fig. 9.1

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With reference to Fig. 9.1, describe **and** explain the changes in blood lactic acid concentration during and after exercise.

[7]

[Total: 9]

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Either

10 (a) Describe the similarities and differences in structure and function of root hairs and villi.

(i) similarities

[3]

(ii) differences

[3]

(b) Describe **and** explain how water molecules from the xylem in the leaf reaches the atmosphere through the leaf.

[4]

[Total: 10]

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OR

10 **(a)** Blood flows through different types of blood vessels after leaving the heart. Draw a line on Fig. 10.1 and Fig. 10.2 to show how the mean blood pressure and diameters of the vessels that blood flows through vary.

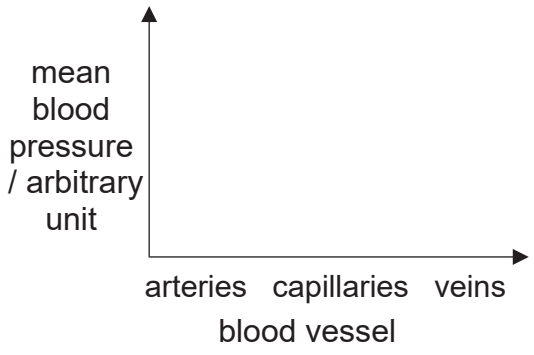


Fig. 10.1

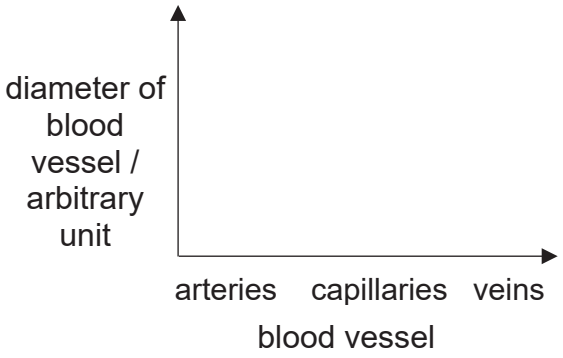


Fig. 10.2 [3]

(b) Using the lines drawn in **(a)** and your biological knowledge, explain the difference in the mean blood pressure in an artery and in a vein.

.....

.....

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..... [4]

(c) Suggest how a narrowed coronary artery may affect heart function.

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..... [3]

[Total: 10]

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FUHUA SECONDARY SCHOOL
PURE BIOLOGY 6093
SECONDARY 4 PRELIMINARY EXAMINATION 2018
MARK SCHEME

PAPER 1 : MULTIPLE CHOICE QUESTION
TOTAL: 40 MARKS

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

PAPER 2 (TOTAL: 80 MARKS)
SECTION A: STRUCTURED QUESTIONS (50 MARKS)

Abbreviations

;	separates marking points
/	alternatives
()	contents of brackets are not required but should be implied
R	reject
A	accept (for answers correctly cued by the question, or guidance for examiners)
Ig	ignore (for incorrect but irrelevant responses)
AW	alternative wording (where responses vary more than usual)
AVP	alternative valid point (where a greater than usual variety of responses is expected)
ORA	or reverse argument
underline	actual word underlined must be used by candidate (grammatical variants excepted)
+	statements on both sides of the + are needed for that mark

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Qn		Suggested marking points	Marks
1	(a)	K: Oxygen/O_2 ; L: carbon dioxide/CO_2/water vapour ; explanation no chlorophyll/no chloroplasts + No photosynthesis ; respiration; **A** transpiration if water vapour given for L ;	4 (max 4)
	(b)	E (Anther) produces/manufacture pollen grains/male gametes ;	1
	(c)(i)	(16-20)/20 x100% = -20% Sign + answer ;	1
	(c)(ii)	Maximum rate of photosynthesis is reached ; Ig Graph levels off/remains constant. Concentration of carbon dioxide is not the limiting factor/ another **named** factor such as light intensity, temperature is the limiting factor ;	2
		Total:	8
2	(a)	containing only two complete set of chromosomes ;	1
	(b)	12 ;	1
	(c)	*Any 2 points below:* gametes from same individual ; self-fertilisation/described ; only new source of variation is mutation ; variation produced by meiosis ;	2 (max 2)
	(d)(i)	Meiosis ;	1
	(d)(ii)	*Any 2 points below:* reduction division/chromosome number is halved ; prevents doubling of chromosome number, with each generation/when nuclei of gametes fuse together/at fertilization ; reference to haploid (cells/gametes/sex cells) ; production of gamete/sex cells ;	2 (max 2)
		Total:	7
3	(a)(i)	absence/lack of nerve transmission ; effectors: brain + iris muscles/circular and radial muscles in iris not receiving any nerve transmission **AW** ; no nerve transmission along/via/through motor neurone (from the brain) to (effector or the iris muscle) ; Ig: identification of X as sensory neurone or optic nerve	3
	(a)(ii)	genotype of individual 1 is Gg ; **AND** *Any 2 points below:* individual 4/5 has 2 copies of the recessive allele/genotype is gg/homozygous recessive ; individual 4/5 inherits a copy each from individual 1 and 2/individual 1 and 2 each pass down a recessive allele, g to individual 4/5 ; individual 1 is not affected due to presence of a dominant allele present ;	[1] [2] (max 3)
	(a)(iii)	1/8 or 0.125 or 12.5 %	1

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	(b)(i)	*Any 2 points below:* Change in the base sequence of DNA causing a different protein to be formed **AW ;** Change in the shape of the active site, so tyrosine cannot fit/bind to the active site ; dihydroxyphenyalanine cannot be synthesized from tyrosine if tyrosinase is absent + precursor of melanin is dihydroxphenylalanine **AW** ;	2 (max 2)
	(b)(ii)	Discontinuous variation + no intermediate phenotypes/distinct/separate categories ;	1
		Total:	10
	4(a)	Removal of metabolic waste products from the body ;	1
	(b)(i)	Sample C + presence of proteins ; Protein is <u>forced</u> out of glomerulus/capillary/into Bowman's capsule/into the glomerular filtrate ;	2
	(b)(ii)	Sample A + presence of reducing sugar such as glucose ; Too much glucose in the blood and thus not <u>all</u> glucose in the filtrate is reabsorbed into capillaries ;	2
	(c)(i)	*Any 1 point below:* Lower pressure ; Less/no urea ; Reference to increase/decrease + concentration of ions **AW** ;	1 (max 1)
	(c)(ii)	*Any 2 points below:* Reduced/less efficient in removing urea ; Gentler/less steep concentration gradient of urea between blood and dialysis fluid ; slower rate of diffusion of urea from blood into dialysis fluid ;	2 (max 2)
		Total	8
5	**(a)**	$C_6H_{12}O_6 + 6\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O$ R: word equation/unbalanced equation/wrong formula	1
	(b)	*Any 3 points below:* Stores/removes more carbon than it releases **ORA** ; Supported with data from the table (110 Gigatons for release vs 140 Gigatons for storage) ; Reference to photosynthesis exceeds respiration **ORA** ; Photosynthesis removes carbon from atmosphere while respiration releases carbon into atmosphere ;	3 (max 3)
	(c)	Rich in nitrates **AW** + algae bloom/excessive algae growth + sunlight unable to penetrate and reach below ; Reference to **<u>aerobic</u>** bacteria rapidly multiply using nutrients from dead organic remains, further depleting dissolved oxygen; Reference to fishes die due to lack of dissolved oxygen ;	3
		Total	7
6	**(a)**	Hepatic artery ;	1
	(b)(i)	*Any 2 points below:* (concentration high) in the blood vessel P (hepatic portal vein) is blood with glucose absorbed from the intestine ; concentration is lower in the blood vessel Q (hepatic vein) ; Action of insulin to stimulate the conversion of excess glucose to glycogen in the liver/ glucose absorbed into liver cells ;	2 (max 2)
	(b)(ii)	7 mmol dm^{-3} ; Note: units must be quoted.	1
		Total:	4

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7	**(a)**	negative feedback ;	1
	(b)	*Any 3 points below:* Release more sweat ; Evaporation of water (in sweat) ; uses heat from body / skin / blood / refer to removal of latent heat of vaporisation ; results in evaporative cooling ;	3 (max 3)
	(c)(i)	*Any 1 point below:* Rate of transpiration decreases as relative humidity increases ORA ; The higher the relative humidity, the shorter the distance moved by the meniscus ORA;	1 (max 1)
	(c)(ii)	*Any 1 point below:* Decrease in temperature ; Decrease in wind speed ; Decrease in light intensity ;	1 (max 1)
		Total	6

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SECTION B: FREE RESPONSE QUESTIONS (30 MARKS)

Qn		Suggested marking points	Marks
8	**(a)**	Appropriate scale used (occupation of graph > 50% of grid provided) ; Points plotted correctly for both curves ; Graph labelled – soy bean and wheat ; Correct graph type – Point to point. (Reject if extrapolation from origin) ;	4
	(b)	Both increase in growth ; Growth for soybean is more than growth for wheat ; Soybean growth levels off/become relatively constant but wheat growth continue to increase ;	3
	(c)	*Any 4 points below:* More food produced + Comparative data manipulation (12000 loaves vs 1200 portions of meat OR 25x more mass/10x more food products) ; Fewer levels in food chain **AW** ; Less energy lost/more efficient ; Energy loss between/within trophic levels ; e.g of energy lost in animal's metabolism/ respiration/movement/excretion ; Correct reference to herbivore/carnivore + human ; Correct reference to primary/secondary + consumer ;	4 (max 4)
		Total	11
9	**(a)**	*Any 2 points below*: Cell division/cell growth/tissue repair/reproduction/embryo development ; Transmission of nerve impulses ; Maintenance of constant body temperature ; Chemical reactions ; Active transport of absorbed named substances in to villi/in small intestine ; Excretion (selective reabsorption of glucose /ions) ; AVP ;	2 (max 2)
	(b)	*Description:* Lactic acid concentration increases, steeply/quickly/**AW**, during exercise ; Decreases steeply, then gradually after exercise ; Any use of figures (e.g peak at 13.2 mmol dm^{-3} at 15 minutes) ; **AND** *Any 4 points below for explanation:* Oxygen, demand increases/does not reach muscles fast enough/**AW** ; Anaerobic respiration ; Provides/releases energy or **A** Produces ATP ; **R**: produce/makes energy Anaerobic respiration produces lactic acid ; Lactic acid diffuses from muscles into the blood ; Lactic acid, is broken down/respired/oxidised/converted to glucose/**AW** in the liver ; Reference to oxygen debt ;	7 (max 7)
		Total:	9

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10E	**(a)(i)**	*Any 3 points below (2 structural + 1 functional or 1 structural + 2 functional)* Structural similarities: Long/elongated ; Provides large surface area ; Functional similarities: Absorption/uptake of ions/salts/minerals/named/water ; Active transport/diffusion involved ;	3 (max 3)
	(a)(ii)	*Any 3 points below (2 structural + 1 functional or 1 structural + 2 functional)* Structural differences: Cell wall vs no cell wall ; (root hair) part of one cell ; (villi) many cells/multicellular ; Reference to absence of blood vessels/lacterals/**ORA**; AVP ; Functional differences: Root hairs + absorb from the soil ; Villi + absorb from the gut/small intestine ; Villi + absorb from amino acids ; Villi + absorb glucose ; Vili + absorb lipids/glycerol/fatty facids ;	3 (max 3)
	(b)	Any 4 points below: Pathway: (xylem) → mesophyll cells → intercellular air spaces → (atmosphere); Process: osmosis for xylem to mesophyll cells + down water potential gradient ; Process: diffusion of water vapour from intercellular air space to atmosphere ; Through stomata ; Evaporation of water/ reference to water vapour formation ;	4 (max 4)
		Total:	10
10O	**(a)**	Mean blood pressure (decreases but not touching zero); Diameter: Line decreases (lowest at capillaries) followed by increase ; Vein diameter drawn to be higher than the artery;	3
	(b)	*Any 4 points below:* Reference to heart/ventricle + pump/source of pressure ; Pressure relates to distance from heart/pump **A**: arteries take blood from/are close to heart ; Resistance/friction ; Narrow lumen (in artery) **ORA** for vein ; Thick/muscular/elastic walls (in artery) ; Generation of tissue fluid in capillaries ;	4 (max 4)
	(c)	*Any 3 points below:* Less blood flow containing oxygen/glucose (through coronary artery) **R**: no blood flow ; to cardiac/heart muscle/muscle cells ; Less aerobic respiration/described of the muscle cells (**R**: no aerobic respiration) ; Heart muscle/cells cannot contract much/less forceful contraction (**R:** no contraction) ;	3 (max 3)
		Total:	10

THE END

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