East Spring Secondary School

Towards Excellence and Success

Name: ..... ( )

Class: .....

Second Semestral Assessment 2019
Secondary 3 Express

Biology **6093**

7 October 2019 **2 h**
Monday **1130 – 1330**

Additional materials:
1 sheet of OTAS

INSTRUCTIONS TO CANDIDATES

Write your name, class and register number in the spaces provided above, and on all the work you hand in.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Calculators and mathematical sets are allowed.

Section A [20 marks]
Answer all questions on the OTAS.

Section B [50 marks]
Answer all questions.
Write your answers in the spaces provided.

Section C [20 marks]
Question 9 is compulsory. Choose 10 Either or Or.
Write your answers in the spaces provided.

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

Section A	20
Section B	50
Section C	20
Total	90

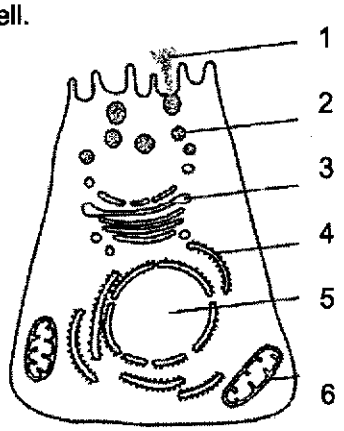
This question paper consists of 22 printed pages including the cover page.

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Section A [20 marks]
Answer all questions and shade your answers on the OTAS.

1 The diagram shows an animal cell.



Which of the following shows the functional relationship between the labelled structures?

A 1 is synthesized by 4.
B 2 fuses with 3.
C 3 contains the products synthesized by 5.
D 6 controls the movement of 2.

2 The diagram shows 4 types of cells not drawn to scale. Which of the following is not adapted for transport?

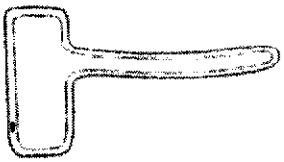
A



B



C



D



3 A student cut five identical beetroot strips, each weighing 10.0 g. Five beakers containing 100cm^3 of sucrose solution of unknown concentrations were prepared and labelled 1 to 5. A beetroot strip was placed in each beaker and left for 30 minutes. The final mass of each beetroot strip was measured and the results tabulated in the following table.

beaker	final mass of beetroot strip/g
1	6.8
2	10.0
3	9.0
4	15.8
5	12.2

Which of the following correctly ranks the water potential of the solutions in beakers 1 to 5 from lowest to highest?

	lowest → highest				
A	1	3	5	4	2
B	2	4	5	3	1
C	1	3	2	5	4
D	4	5	2	3	1

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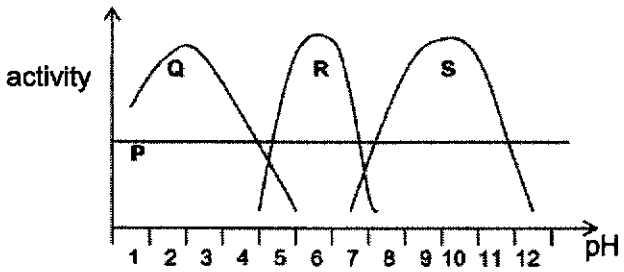
4 A student was asked to identify the two compounds in each of three test tubes. The table shows the results of the student's tests.

test tube	reagent(s) added to test-tubes containing compounds		
	sodium hydroxide + copper sulfate	Benedict's solution	iodine in potassium iodide
X	purple	brick-red precipitate	yellowish-brown
Y	blue	blue	blue-black
Z	purple	blue	blue-black

Which conclusion is consistent with the results?

A egg white and sucrose had been placed in tube **X**.
B glucose and sucrose had been placed in tube **X**.
C starch and sucrose had been placed in tube **Y**.
D starch and maltose had been placed in tube **Z**.

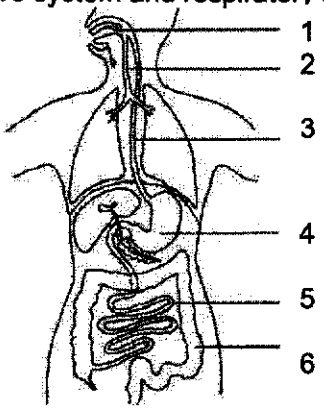
5 The graph shows the effect of pH on the activity of four different substances taken from the digestive system.



Which pair of substances is involved in the digestion of fats?

A **P** and **Q**
B **P** and **S**
C **R** and **Q**
D **R** and **S**

6 The diagram shows the digestive system and respiratory system of man.

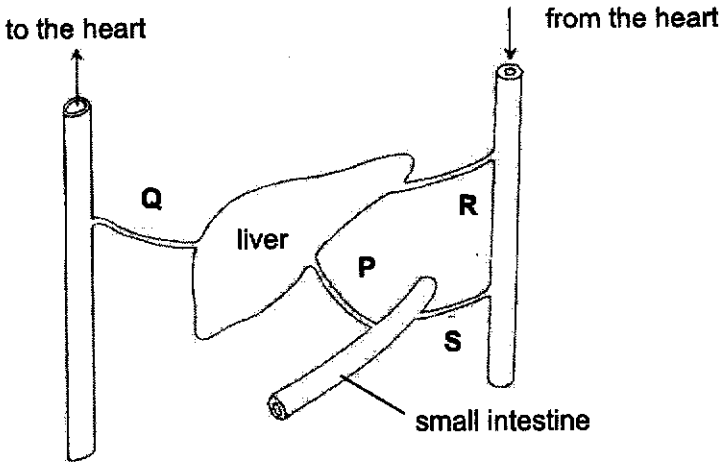


Which of the following processes that take place in the parts labelled is correct?

	peristalsis	chemical digestion	osmosis
A	1	3	5
B	1	4	6
C	2	6	5
D	3	5	6

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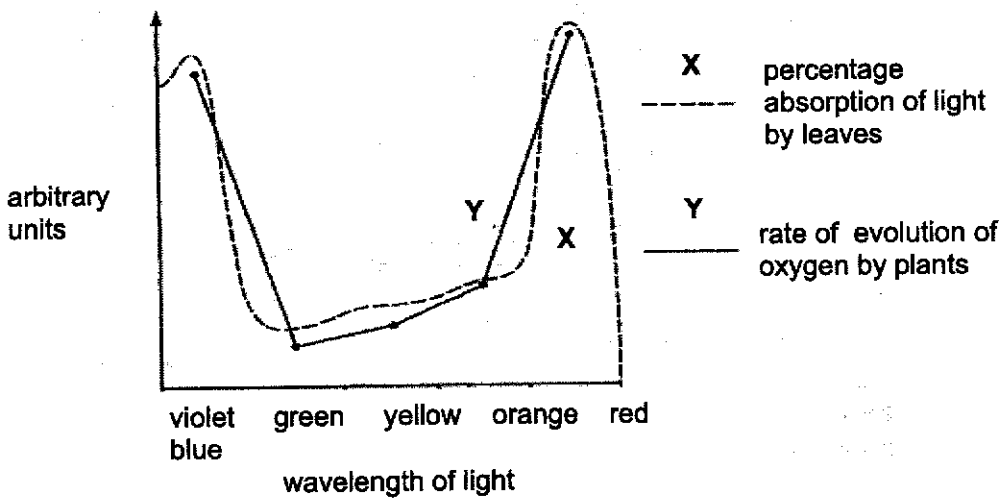
7 The following diagram shows part of the digestive system with its associated blood vessels.



Which of the following is correct after a meal rich in carbohydrates and proteins?

	highest glucose concentration	highest urea concentration
A	P	S
B	S	P
C	P	Q
D	Q	S

8 The graph shows the effect of different wavelengths of light on processes taking place in green plants.



What can be deduced from the solid line **Y**?

A The rate of photosynthesis is the lowest in green light and highest in blue and red light.

B The rate of photosynthesis is the highest in green light and lowest in blue and red light.

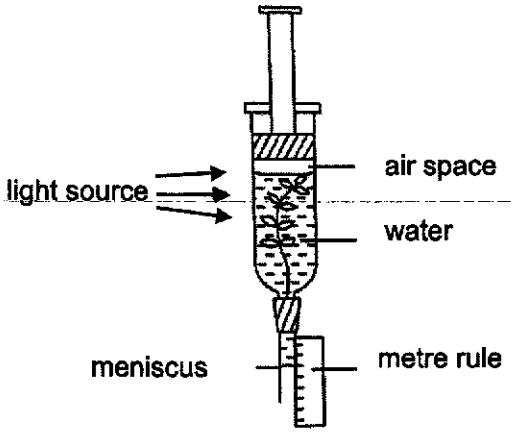
C The rate of respiration is the lowest in green light and highest in blue and red light.

D The rate of respiration is the highest in green light and lowest in blue and red light.

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9 The diagram shows an experiment conducted by a student.

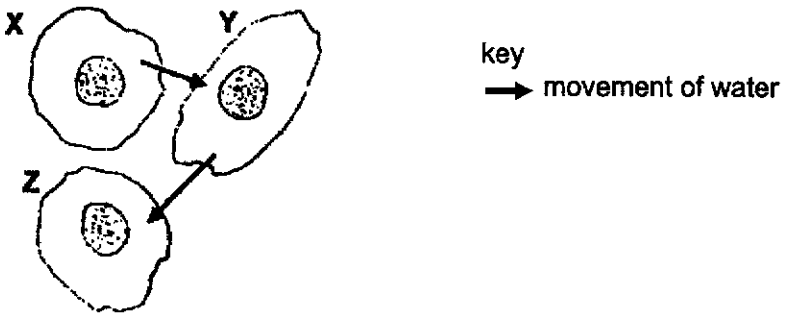


A student decided to replace the water with equal volume of dilute sodium bicarbonate solution.

Which of the observations would likely be seen?

A The meniscus will move upwards at a faster rate.
B The meniscus will move upwards at a slower rate.
C The meniscus will move downwards at a faster rate.
D The meniscus will move downwards at a slower rate.

10 Three cells of different water potentials (Ψ) were placed next to each other. Water potential (Ψ) of pure water is 0 kPa. When solute molecules are dissolved in water, water potential is negative (Ψ) = < 0 kPa. As the number of solute molecules increases, water potential becomes more negative.



What should be the water potential (Ψ) in kPa in each cell in order for water to move in the direction shown?

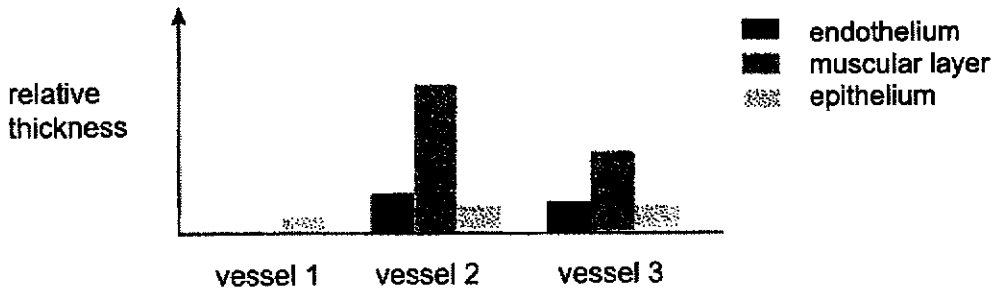
	water potential (Ψ) of X	water potential (Ψ) of Y	water potential (Ψ) of Z
A	− 100	− 60	− 10
B	− 60	− 100	− 10
C	− 10	− 60	− 100
D	− 10	− 100	− 60

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11 When the skin is cut, a blood clot is formed. In which order would the components of the blood be involved?

	first → last			
A	fibrin	platelet	red blood cell	fibrinogen
B	fibrinogen	red blood cell	platelet	fibrin
C	platelet	fibrin	fibrinogen	red blood cell
D	platelet	fibrinogen	fibrin	red blood cell

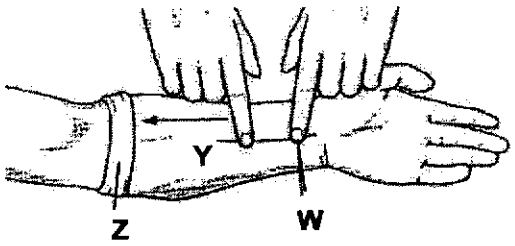
12 The graph shows the relative thickness of the three main layers of blood vessels.



Which of the following correctly identifies vessels 1, 2 and 3?

	vessel 1	vessel 2	vessel 3
A	artery	capillary	vein
B	capillary	vein	artery
C	capillary	artery	vein
D	vein	artery	capillary

13 The diagram shows the investigation of blood flow in the vein of the lower arm.



A cloth is tightly wrapped around the arm at point **Z** and the veins stand out clearly. One finger presses on the vein at **W**.

When another finger strokes the vein, as shown in the diagram, the vein lies flat between the points **W** and **Y**.

Some possible explanations are listed.

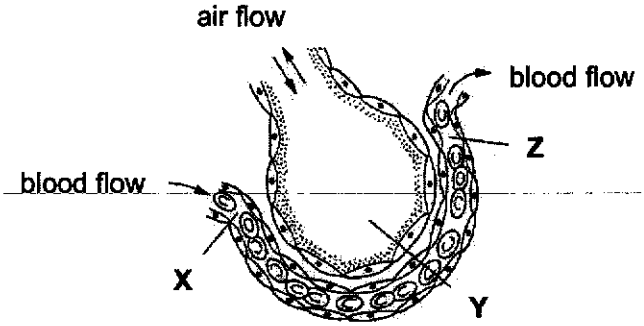
1 The bandage at **Z** prevents backflow of blood.
2 The finger pressed at **W** prevents more blood from entering the vein.
3 A valve at **Y** prevents backflow.
4 A valve at **Z** prevents more blood from entering the vein.

Which explanations of the vein lying flat are correct?

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

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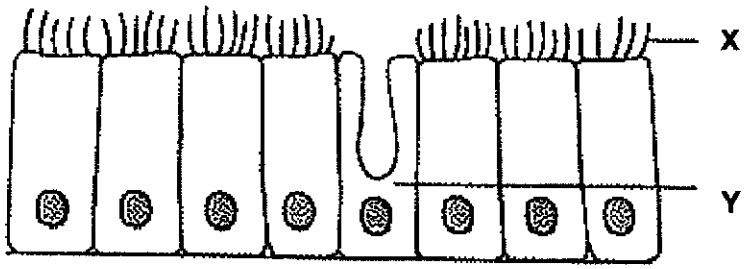
14 The diagram shows a cross-section of an alveolus.



Which of the following is true about the concentration of oxygen at that region?

	X	Y	Z
A	high	low	high
B	high	low	low
C	low	high	high
D	low	high	low

15 The diagram shows the epithelial cells in the inner lining of the respiratory tract.



Mutated cells possessing structure **X** do not contain mitochondria. Which of the following would be a likely consequence of this?

A accumulation of dust and mucus in the trachea
B increase in temperature of inhaled air
C reduced efficiency of gaseous exchange
D reduced perception of smell

16 Which of the following condition(s) is/are caused by carbon monoxide from cigarette smoke?

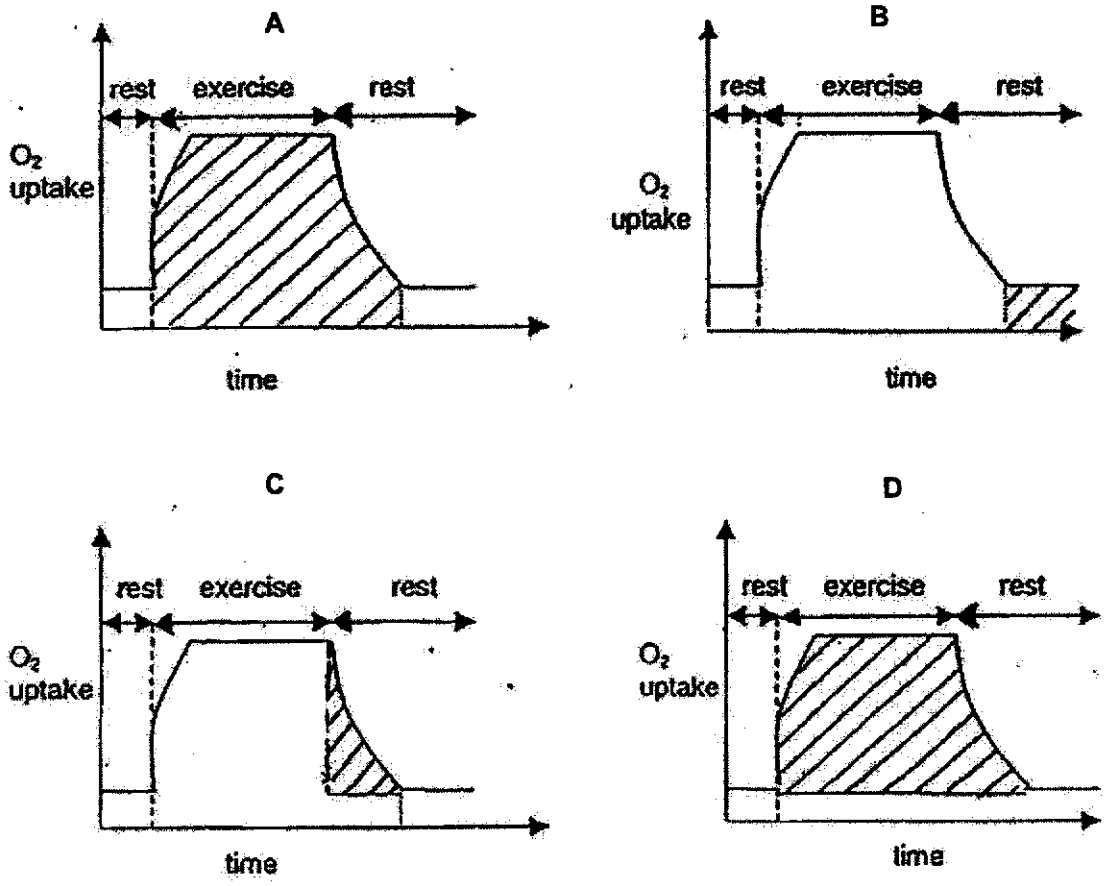
1 addiction
2 reduced efficiency of oxygen transport by red blood cells
3 increased deposition of fatty substances on the inner walls of arteries

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

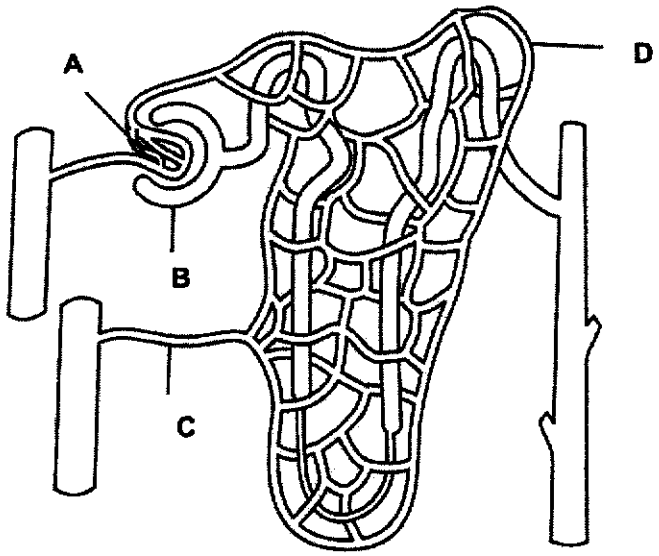
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17 The graphs below show how oxygen uptake changes with time during periods of rest and exercise.

Which shaded area represents the oxygen uptake used to repay the oxygen debt?



18 The diagram below shows a nephron and its associated blood vessels. Which part has the highest blood pressure?



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19 What happens when a person drinks large volume of water?

	amount of ADH secreted	reabsorption of water from kidney tubule	volume of urine produced
A	less	less	more
B	less	more	less
C	more	less	more
D	more	more	less

20 Which factors are controlled by homeostasis?

	glucose concentration in blood	water concentration in the ileum	temperature in the stomach	pH in the duodenum
A	✓	✓	×	✓
B	✓	✓	✓	×
C	✓	×	✓	×
D	×	✓	✓	×

key
✓ = controlled by homeostasis
× = not controlled by homeostasis

End of Section A

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Section B [50 marks]
Answer all questions in the spaces provided.

1 Manuel made a model of a plant cell for his science project. He used a Visking tubing which was enclosed in a flexible permeable membrane as shown in Fig 1.1.

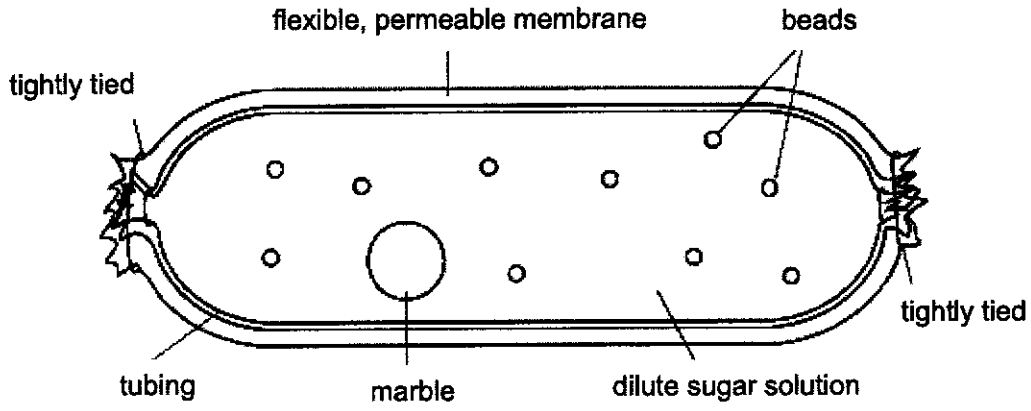


Fig 1.1

(a) Name the structures found in a plant cell that are best represented by the following items used in his model:

(i) the beads;

..... **[1]**

(ii) the marbles;

..... **[1]**

(iii) the Visking tubing.

..... **[1]**

(b) State one structure found in a typical plant cell that is not represented in the student's model.

..... **[1]**

[Total: 4]

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2 Fig 2.1 shows a diagrammatic example of the breakdown of sucrose.

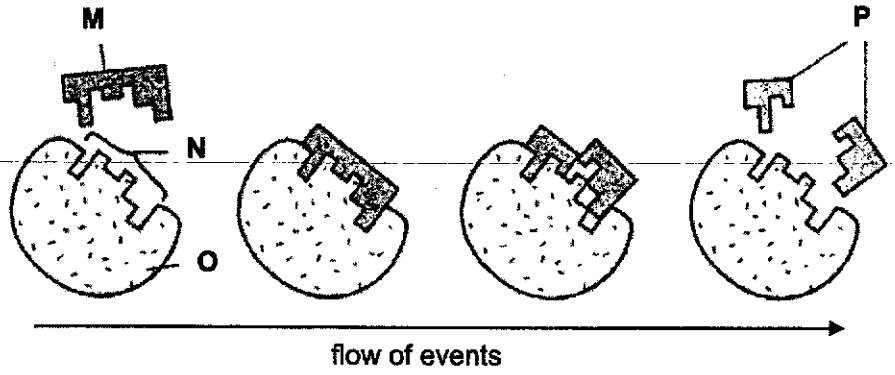


Fig 2.1

(a) Identify **M**, **N**, **O** and **P**.

M..... **N**.....

O..... **P**..... **[2]**

(b) Acetylcholine is a chemical found in the nervous system. It controls the electrical signals for muscle movements in many organisms. An enzyme, acetylcholinesterase, catalyses the breakdown of acetylcholine when no muscle movements are required. Insecticides have the ability to alter the structure of acetylcholinesterase. As a result, insects exposed to insecticides would have uncoordinated movements and even paralysis.

Explain, in terms of the lock-and-key hypothesis, how the alteration of the acetylcholinesterase led to the signs seen in insects.

.....

.....

.....

.....

.....

..... **[3]**

[Total: 5]

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3 Fig 3.1 is an excerpt from the internet about Xerophytes which is a specialised group of plants that survive in very dry regions.

> Xerophytes are plants adapted to life in a dry or physiologically dry habitat (salt marsh, saline soil, or acid bog) by means of mechanisms to prevent water loss or to store available water. Succulents (plants that store water) such as cacti and agaves have thick, fleshy stems or leaves. Other xerophytic adaptations include waxy leaf coatings, the ability to drop leaves during dry periods, the ability to reposition or fold leaves to reduce sunlight absorption, and the development of a dense, hairy leaf covering.
> https://www.britannica.com/plant/xerophyte

Fig 3.1

Figure 3.2 shows the structure of a leaf of a xerophyte.

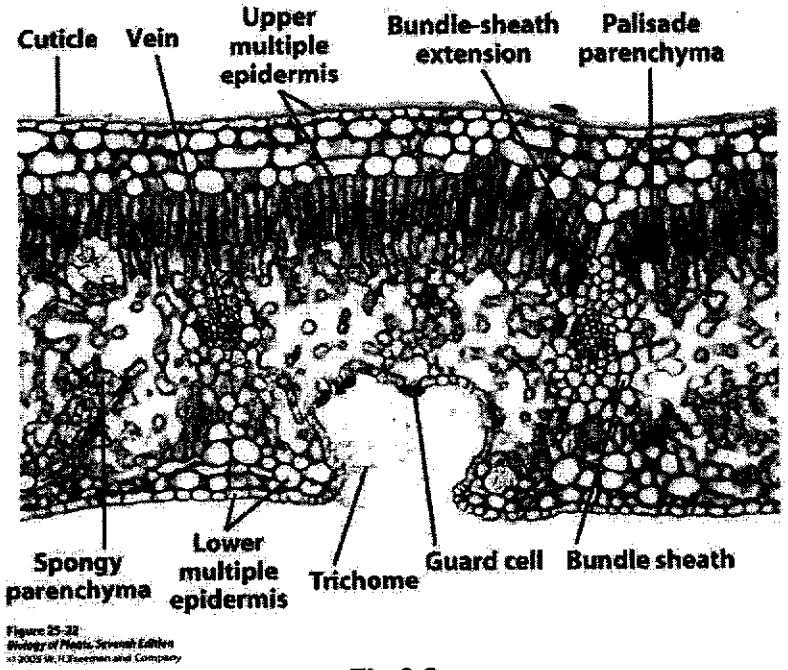


Fig 3.2

(a) Explain why the leaves of xerophytes have thick waxy coatings.

.....

..... **[2]**

(b) With respect to Fig 3.2, explain how xerophytic leaves are adapted for its function apart from that in (a).

.....

.....

.....

..... **[2]**

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(c) Fig 3.3 below is an apparatus used to measure the rate of transpiration in the xerophyte.

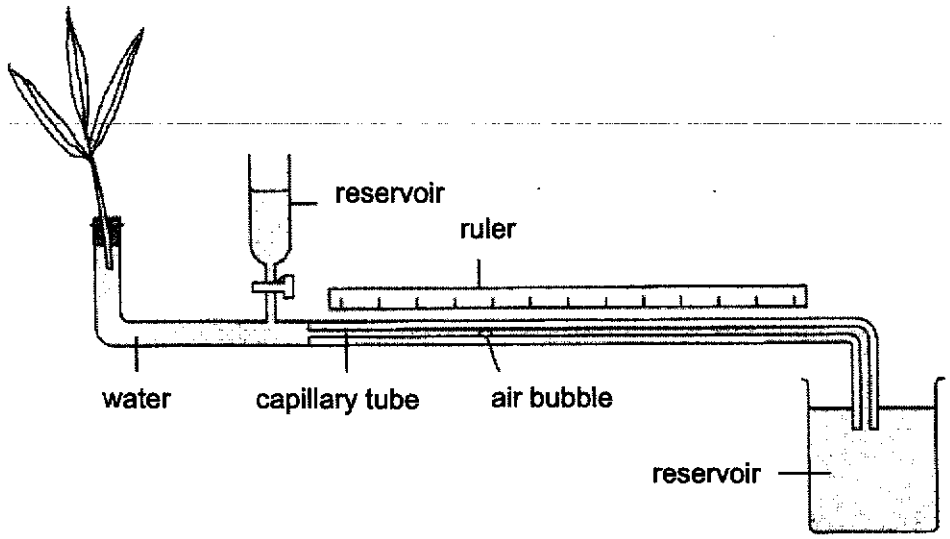


Fig 3.3

(i) State the key assumption made in this experimental set-up to measure the rate of transpiration.

..... **[1]**

(ii) Explain how rate of transpiration can be calculated and state the possible unit used.

.....

.....

..... **[2]**

[Total: 7]

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4 Fig 4.1 shows an experiment to investigate starch production by plants. Three similar plants, each with variegated (green and white) leaves were set up. After being placed in sunlight for 6 hours, the percentage of carbon dioxide present in all jars was measured as shown.

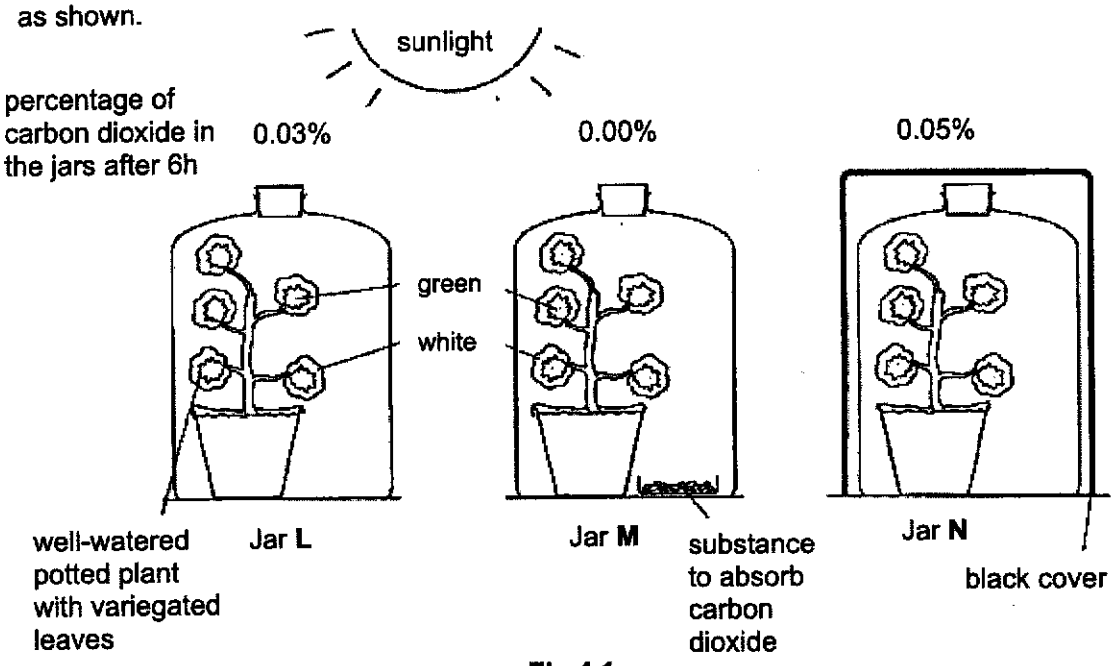


Fig 4.1

(a) At the end of the experiment, a leaf was taken from each plant and tested for the presence of starch. On the outlines in Fig 4.2 below, clearly **label** the colours of each leaf after the starch test. Do **not** colour in the leaves.

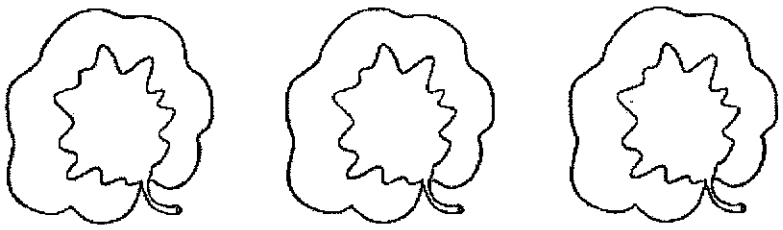


Fig 4.2 **[3]**

(b) When the air was first trapped in the jars before exposing the plants to sunlight, it contained 0.04% carbon dioxide. For Jar **L** and **N**, explain how and why this percentage has changed by the end of the experiment.

Jar **L**: .....

.....

..... **[2]**

Jar **N**: .....

.....

..... **[2]**

[Total: 7]

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5 In a car accident, a victim lost a lot of blood. When the victim was brought to the hospital, the nurse tested his blood to identify his blood group by adding serums from patients with different blood group into his blood. Fig 5.1 below shows the results of the blood test.

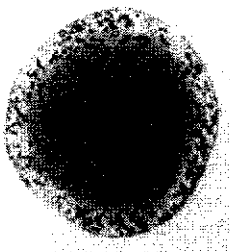
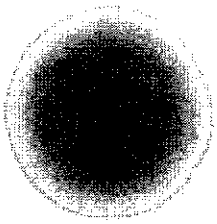
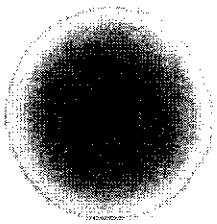
	add serum from blood group **A** patient	add serum from blood group **B** patient	add serum from blood group **AB** patient
resulting mixture of victim's blood sample with serum			

Fig 5.1

(a) **(i)** What is the blood group of the victim?

..... **[1]**

(ii) Explain your answer based on the test results above.

.....

.....

.....

.....

.....

..... **[3]**

(b) Explain what happens if the victim's blood sample is mixed with serum from blood type **O** patients.

.....

.....

..... **[2]**

[Total: 6]

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6 Fig 6.1 below shows the pressure changes in the left side of the heart during a cardiac cycle.

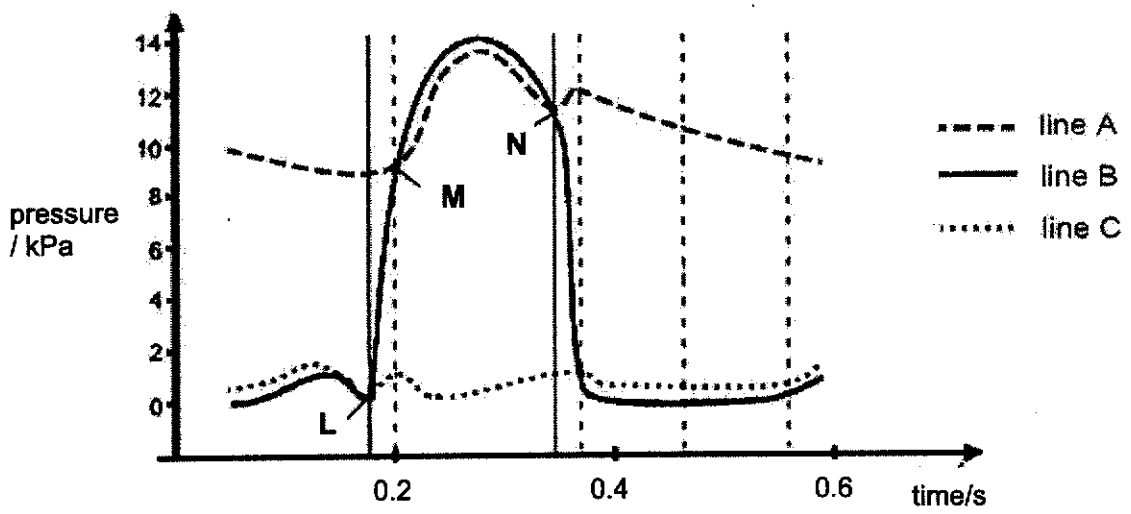


Fig 6.1

(a) State the locations in the heart represented by **A**, **B** and **C**.

line **A**: ..... line **B**: .....

line **C**: ..... **[3]**

(b) Describe what happens in the left side of the heart at point **L**.

.....

.....

..... **[2]**

(c) Using Fig 6.1, describe what happens in the heart between **M** and **N**.

.....

.....

.....

.....

..... **[3]**

[Total: 8]

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7 (a) Describe two differences between aerobic and anaerobic respiration in humans.

1. .....

.....

2. .....

..... [2]

(b) Fig. 7.1 shows the amount of blood (cm^3 per minute) flowing through the whole body and different parts of the body at rest and during exercise of an athlete.

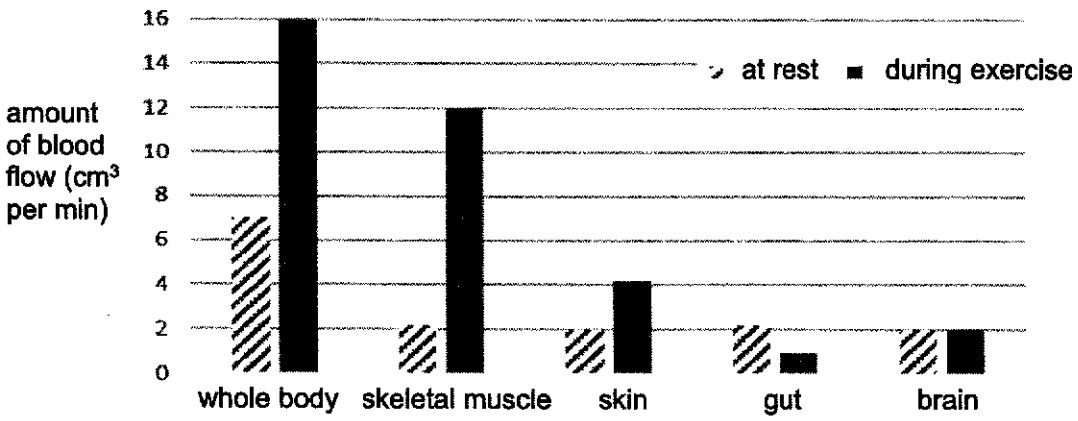


Fig 7.1

(i) State the part of the body that shows the most significant increase in blood supply during exercise.

..... [1]

(ii) Explain your answer in (b)(i).

.....

.....

.....

..... [2]

(iii) While exercising at a constant rate, the muscles in the athlete's body produced lactic acid as a result of cellular activities. Explain why the concentration of lactic acid decreases after one minute of rest.

.....

.....

.....

..... [2]

[Total: 7]

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8 Fig 8.1 shows changes in the body temperature of a person.

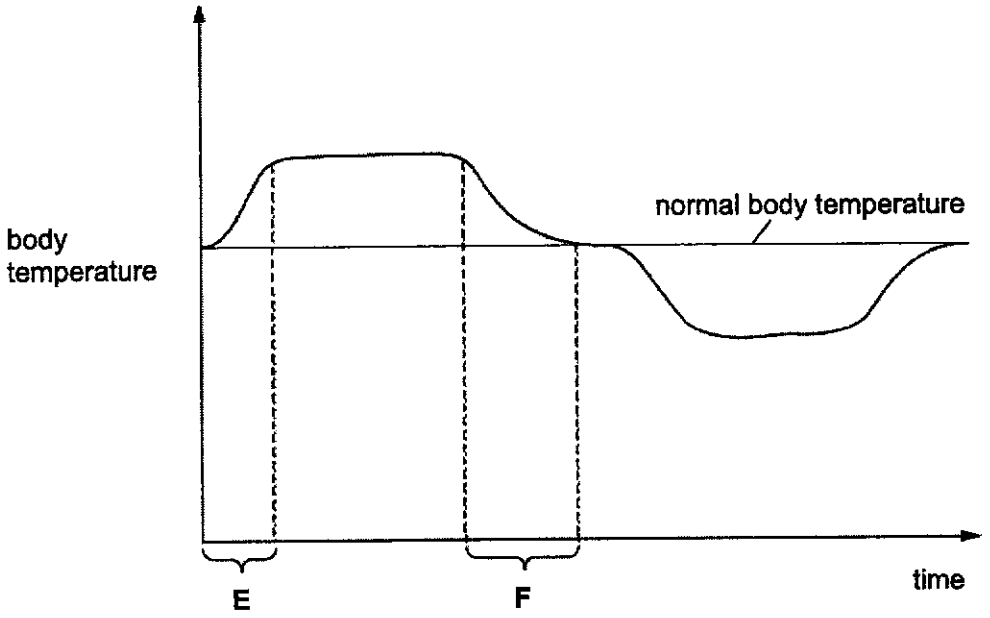


Fig 8.1

(a) Define homeostasis.

.....

..... **[1]**

(b) Suggest two things that could happen to account for the shape of the curve during time **E**.

1. .....

.....

2. .....

..... **[2]**

(c) Explain what is happening in the body to cause the change in body temperature at time **F**.

.....

.....

.....

.....

.....

..... **[3]**

[Total: 6]

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Section C [20 marks]
Question 9 is compulsory. Choose 10 Either or Or.
Write your answers in the spaces provided.

9 Fig 9.1 shows a human heart which has a narrowed blood vessel labelled **F**.

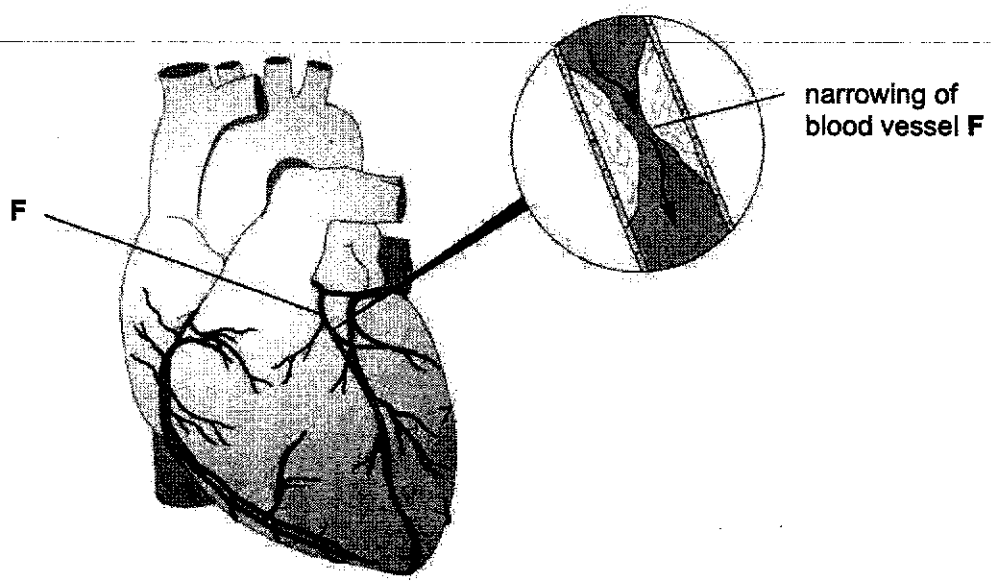


Fig 9.1

(a) **(i)** Name the blood vessel **F**.

..... **[1]**

(ii) State two factors that may lead to the narrowing of this blood vessel.

1. .....

.....

2. .....

..... **[2]**

(iii) Suggest and explain how a person might be affected by the disease caused by the narrowing of blood vessel **F**.

.....

.....

.....

.....

.....

.....

..... **[4]**

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(b) It is possible to treat the condition caused by the narrowing of blood vessel **F**, by carrying out an operation as shown in Fig 9.2.

In the operation, a balloon surrounded by a metal mesh is inserted into the blood vessel and inflated. The balloon is then deflated and removed, leaving the metal mesh in place.

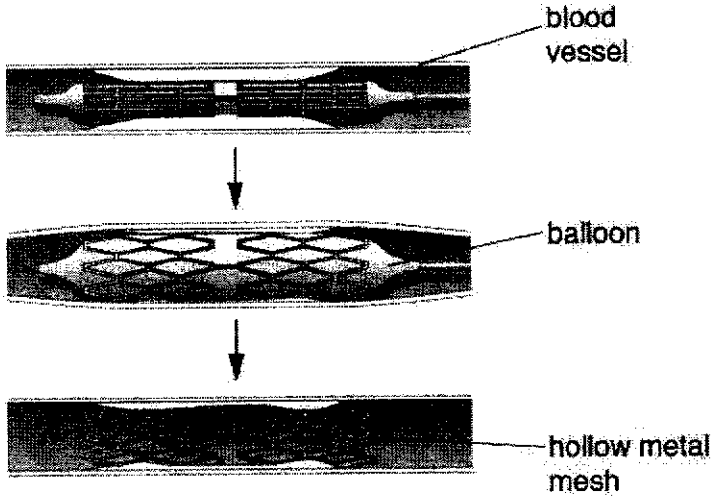


Fig. 9.2

Suggest the purpose of each of the following:

(i) inflating the balloon,

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.....

..... **[2]**

(ii) leaving the hollow metal mesh in the blood vessel.

.....

..... **[1]**

[Total: 10]

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10 **Either**

(a) Explain how air is made to enter the lungs.

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..... **[5]**

(b) Describe how the gaseous waste product from aerobic respiration in the human skeletal muscle cells are removed from the body.

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..... **[5]**

[Total: 10]

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10 **OR**

(a) Describe the similarities and differences between xylem tissues and phloem tissues.

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..... **[5]**

(b) Explain how an increase in air movement surrounding the plant affects the loss of water.

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[Total: 10]

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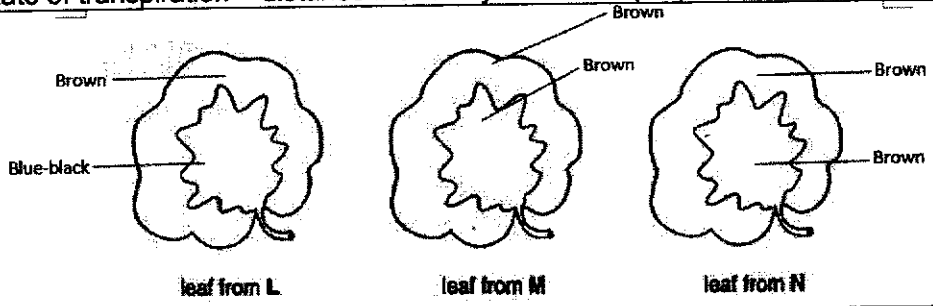
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2019 East Spring Secondary 3 Pure Biology 6093 2SE

Section A

1	A	6	D	11	D	16	C
2	D	7	C	12	C	17	C
3	C	8	A	13	C	18	A
4	C	9	C	14	C	19	A
5	B	10	C	15	A	20	B

Section B

1	ai	chloroplasts/starch granules/mitochondria/vesicles *(any one)*	[1]
	aii	nucleus	[1]
	aiii	cell surface membrane	[1]
	b	large central vacuole / ribosomes / mitochondria /tonoplast/RER/SER/Golgi body *(any one)* Accept: Chloroplasts can be correct if the students wrote other answer in 1(a)(i)	[1]
2	a	1m for two correct answers **M:** sucrose **N:** active site **O:** sucrase **P:** glucose and fructose	[2]
	b	Alteration of enzyme (acetylcholinesterase) structure have resulted in a **change in the shape/denaturation** of the enzyme's active site [1] Active site would **no longer be complementary** to the shape of the substrate (acetylcholine) molecule [1] **No enzyme-substrate complex** would be formed and acetylcholine can no longer be broken down by acetylcholinesterase [1]	[3]
3	a	The cuticle cuts down water loss in two ways: it acts as a barrier to evaporation and also the shiny surface reflects heat and so lowers temperature.	[2]
	b	Sunken stomata. Stomata may be sunk in pits in the epidermis; moist air trapped here lengthens the diffusion pathway and reduces evaporation rate. OR Leaf rolled with stomata inside: The inner surface is covered in hairs. The rolled leaf and hairs both serve to trap moist air so reducing transpiration. In addition, a smaller surface area of leaf is exposed to the drying effects of the wind.	[2]
	ci	The assumption is that the rate of absorption is equal to the rate of water lost through transpiration.	[1]
	cii	Rate of transpiration = distance moved by air bubble (cm) /Time taken (min)	[2]
4	a		[3]

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4	b	Jar L : CO_2 percentage dropped; [1] more CO_2 used for photosynthesis than produced in respiration Jar N : CO_2 percentage increased; no photosynthesis to use up CO_2 due to black cover and respiration increases amount of CO_2	[4]
5	ai	Blood group B	[1]
	aii	Antibody b present in serum A; ref. agglutinates with antigen B on red blood cells/victim's blood; Serum B and AB does not contain antibody B hence no agglutination/clumping; cannot be blood group AB since it is a universal acceptor, but clumping was observed with blood group A	[3]
	b	agglutination occurs; serum of blood group O contains antibody b (that binds with antigen B on RBC- optional if credited in part a);	[2]
6	a	line A: Aorta [1] line B: Left ventricle [1] line C: Left atrium [1]	[3]
	b	The pressure in the left ventricle becomes higher than the pressure in the left atrium. [1] The bicuspid valve then closes. [1]	[2]
	c	Pressure in the left ventricle becomes higher than the pressure in the aorta. [1] Semi-lunar/aortic valve opens. [1] Blood enters the aorta from the left ventricle. [1]	[3]
7	a	aerobic respiration requires oxygen, but anaerobic respiration does not require oxygen [1]; aerobic respiration releases more energy than anaerobic respiration.[1] OR the products of aerobic respiration are carbon dioxide and water while that of anaerobic respiration is lactic acid. [1] Any 2	[2]
	bii	Skeletal muscle	[1]
	bii	The heart rate increases, to increase the rate of blood flow to the muscles; To allow more oxygen and glucose to reach the muscle cells; This is because during exercise, there is an increase in the rate of aerobic respiration in muscles; to release more energy for muscular contractions;	[2]
	biii	During rest, breathing rate remains high to take in oxygen; Lactic acid transported to liver to be oxidised to release energy to convert remaining lactic acid back to glucose / to carbon dioxide;	[2]
8	a	Homeostasis is the maintenance of a constant internal environement.	[1]
	b	- body temperature increased; - exercise - increased/ high + surrounding temperature; - increased/ high + surrounding humidity; - hot + food/ drink; - increased/ high + metabolism/ respiration; - fever/ illness; - ovulation; - wear more clothes;	[2]
	c	- sweat glands become more active, increases the production of sweat/ increased sweating + evaporation of water; - vasodilation + more blood + skin; - heat loss/ radiation; - reduced + metabolism/ respiration;	[3]

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Section C

9	ai	Coronary artery;	[1]
	aii	fat/ oil/ cholesterol + diet AW; stress AW; smoking; genetics/ inheritance AW; lack of exercise; old age; obesity ;	[2]
	aiii	1 heart attack AW/ heart stops/ angina AW/ breathlessness; 2 less blood + to body/ tissues/ organs or any named; 3 less oxygen/ glucose + to body/ tissues/ organs or any named; 4 less aerobic respiration or more anaerobic respiration; 5 production of lactic acid; 6 less ability AW + of heart to contract/ pump blood; 7 less ability AW + to carry out physical activity;	[4]
	bi	(inflating the balloon) 1 opens metal mesh AW ; 2 push / compress+ blockage / fat ; 3 widen AW + blood vessel / lumen AW ;	[2]
	bii	(leaving the hollow metal mesh in the blood vessel) 4 maintain AW + wider lumen AW ; 5 increase AW + blood flow ;	[1]

10	Either a	• During inspiration, the external intercostal muscle contract, while the internal intercostal muscle relax.[1] • The diaphragm contracts and flatten. [1] • The ribcage is raised upwards and outwards, while the sternum moves up and away from the backbone. [1] • This increases the volume of the thoracic cavity [1] , and lowers the pressure in the lungs, allowing air to be forced into the lungs from the atmosphere with higher pressure.[1]	[5]
	b	• Aerobic respiration involves the release of energy from glucose, releasing water and carbon dioxide as waste products. [1] • The carbon dioxide diffuses out of the respiring cells into the blood plasma and enters the red blood cell (RBC). • In the RBC, the carbon dioxide combines with water in the presence of carbonic anhydrase to from carbonic acid [1]. • The carbonic acid is then converted into hydrogencarbonate ions, which would diffuse into the blood plasma to be transported to the lungs. [1] • In the lungs, the hydrogencarbonate ions would get converted into carbonic acid and then carbon dioxide in the RBC, which enter the alveolar space by diffusion [1] • Carbon dioxide is then removed by exhalation. [1]	[5]

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<table>
<tr><td>10</td><td>OR
a</td><td>Similarities:
• Both xylem and phloem forms the vascular tissues and <u>function in the transport of substances</u> around the plants.
• Both are formed from the <u>division of cambium</u> and found next to each another through leaves, stem and roots for transport.

Differences:<table><tr><th>Xylem</th><th>Phloem</th></tr><tr><td><u>Transports water and dissolved mineral salts</u> from roots to leaves</td><td><u>Transport food (sucrose)</u> from the leaves to all part of plant.</td></tr><tr><td><u>uni-directional</u> transport</td><td><u>Bi-directional</u> transport</td></tr><tr><td>Xylem vessels have <u>empty lumen without cross walls</u> to allow water to move easily</td><td>Phloem is made up of <u>sieve tube elements</u> with very little protoplasm arranged in continuous column to reduce resistance to the flow of substances</td></tr><tr><td>Xylem wall is <u>lignified</u> to provide <u>mechanical support</u></td><td>Every phloem sieve tube cell has a <u>companion cell</u> with mitochondria.</td></tr></table></td><td>[5]</td></tr>
<tr><td></td><td>b</td><td>• When there is an increase in the air movement in the environment, <u>water vapour is continually blown away / removed</u> around the surface of the leaves.[1]
• This leads to <u>lower humidity</u> around the leaves.[1]
• There is a <u>steeper water vapour concentration gradient</u> formed between the inter-cellular air spaces of the leaf and the environment. [1]
• Water vapour diffuse out of the leaf at a faster rate. [1]OR
• Hence, there will be an <u>increased rate of transpiration</u>. [1]</td><td>[5]</td></tr>
</table>

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