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PASIR RIS CREST SECONDARY SCHOOL
End-of-Year Examination
Secondary Three Express

CANDIDATE
NAME

CLASS

	/	
--	---	--

INDEX
NUMBER

Science (Chemistry / Biology)

Paper 1 Multiple Choice

5078/01

11 Oct 2019

1 hour

Additional materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number in the spaces provided.

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

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 Answer Sheet.

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.

A copy of the Data Sheet is printed on page 13.

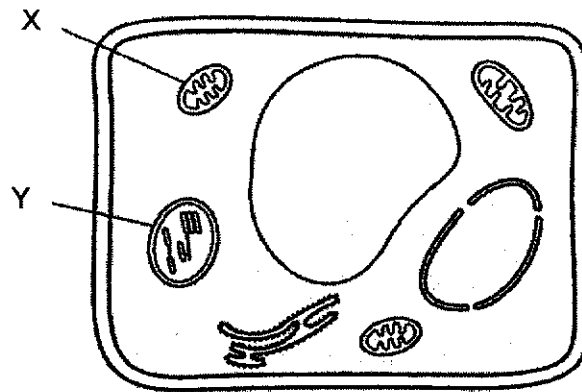
A copy of the Periodic Table is printed on page 14.

The use of an approved scientific calculator is expected, where appropriate.

For Examiner's Use
40
Parent's Signature

This document consists of 14 printed pages, including the cover page.

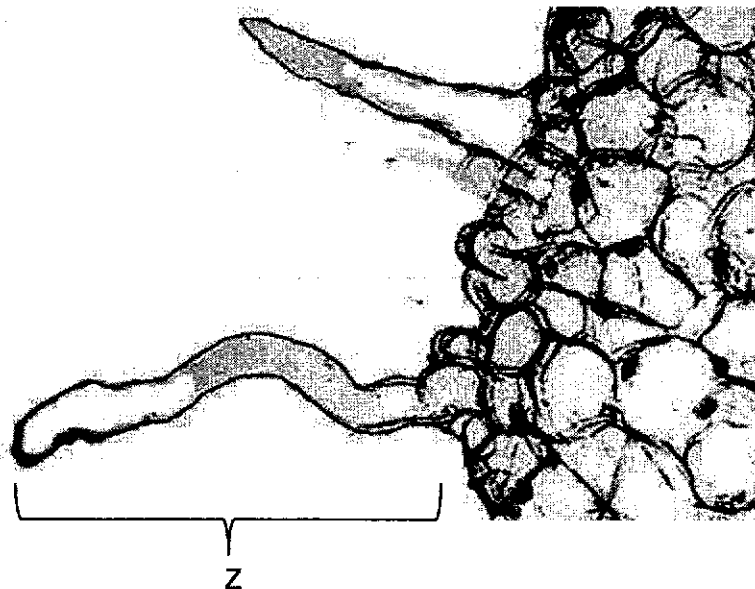
- 21 The diagram shows a plant cell.



Which option describes the correct energy conversions that occur in structures X and Y?

	X	Y
A	light energy to heat energy	heat energy to chemical energy
B	chemical energy to light energy	light energy to chemical energy
C	chemical energy to heat energy	light energy to chemical energy
D	heat energy to chemical energy	chemical energy to light energy

- 22 The diagram shows a photomicrograph of a root of a plant.



What is the function of structure Z?

- A allows for faster absorption of water and mineral salts
- B provides more space for storage of substances
- C transport of water and mineral salts in the plant
- D traps light to carry out photosynthesis

- 23 The diagram shows the sequence of bases along a section of a single strand of DNA.

T	C	A	A	G	C	C	T
---	---	---	---	---	---	---	---

Which of the following shows the sequence of bases in the complementary strand?

- A**

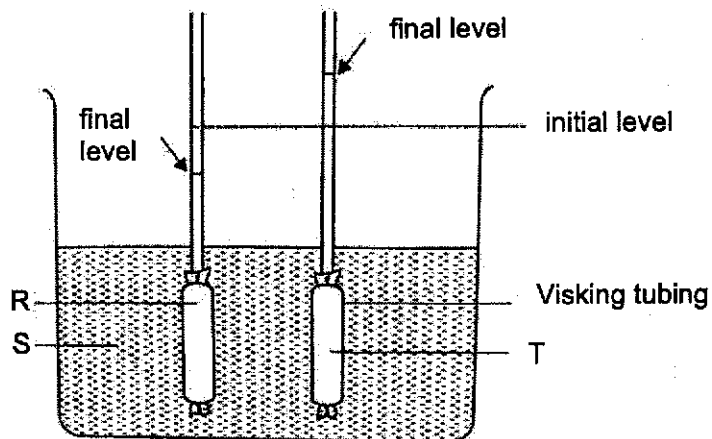
A	G	T	T	C	G	G	A
---	---	---	---	---	---	---	---
- B**

C	T	G	G	A	T	T	C
---	---	---	---	---	---	---	---
- C**

G	A	C	C	T	A	A	G
---	---	---	---	---	---	---	---
- D**

T	C	A	A	G	C	C	T
---	---	---	---	---	---	---	---

- 24 The diagram shows an experiment using three different solutions, R, S and T.



From the results of the experiment, what are the likely concentrations for solutions R, S and T?

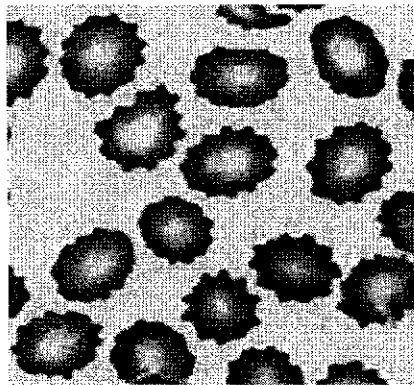
	R	S	T
A	5% sucrose solution	10% sucrose solution	15% sucrose solution
B	10% sucrose solution	15% sucrose solution	5% sucrose solution
C	15% sucrose solution	5% sucrose solution	10% sucrose solution
D	15% sucrose solution	10% sucrose solution	5% sucrose solution

- 25** Four strips were cut from a fresh potato and measured. One strip was placed in water, while the others were placed in sugar solutions of different concentrations. After an hour, the strips were measured again. The results are shown in the table below.

Which potato strip was placed in water?

	original length of strip / mm	final length of strip / mm
A	50	50
B	58	65
C	62	59
D	66	68

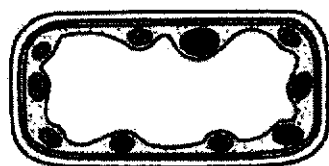
- 26** The diagram shows blood cells after being immersed in a liquid for one hour.



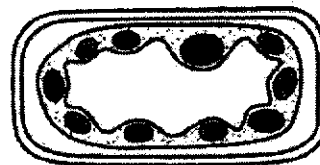
Which statement describes the liquid?

- A** The water potential of the liquid is equal to that of pure water.
- B** The water potential of the liquid is equal to that of the cytoplasm.
- C** The water potential of the liquid is higher than that of the cytoplasm.
- D** The water potential of the liquid is lower than that of the cytoplasm.

- 27 The diagrams show a cell that has been placed in solution X and a similar cell that has been placed in solution Y for 20 minutes.



solution X



solution Y

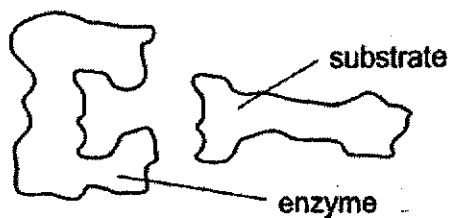
What is the possible explanation for this observation?

	movement of water molecules when placed in solution Y	explanation
A	into the cell	solution Y has higher water potential than solution X.
B	into the cell	solution Y has lower water potential than solution X.
C	out of the cell	solution Y has higher water potential than solution X.
D	out of the cell	solution Y has lower water potential than solution X.

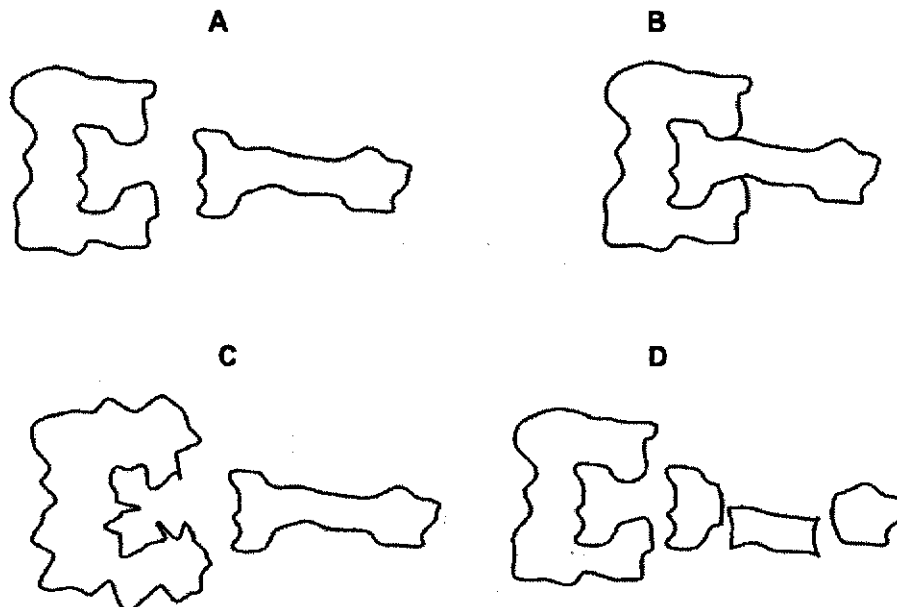
- 28 Which property of the enzyme, amylase, is explained by the 'lock and key' hypothesis?

- A Amylase is a protein.
- B Amylase is inactive at low temperatures.
- C Amylase remains chemically unchanged at the end of the reaction.
- D Amylase can only catalyse one reaction.

- 29 The diagram represents a human enzyme molecule and its substrate.



Which diagram shows these molecules after they are heated to 100 °C?

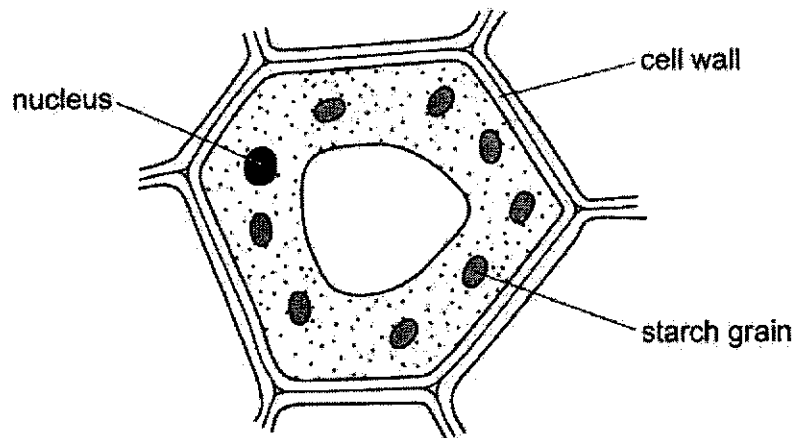


- 30 A sample of milk is mixed with lipase. After 30 minutes, the milk tastes sour and had become more acidic.

What are the substrate and product in this reaction?

	substrate	product
A	fats	amino acids
B	fats	fatty acids
C	proteins	amino acids
D	proteins	fatty acids

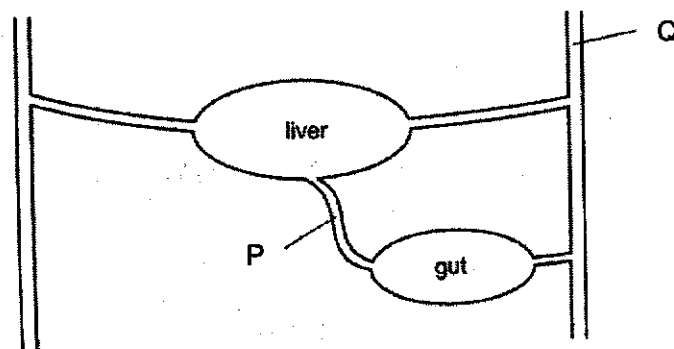
- 31 The plant cell conducts photosynthesis. The product of photosynthesis, glucose, is used to make cellulose for the cell wall and starch for storage. The cell is stained with iodine solution.



After staining, what are the colours of the cell wall and starch grain?

	cell wall	starch grain
A	blue-black	blue-black
B	blue-black	brown
C	brown	brown
D	brown	blue-black

- 32 The diagram shows the liver and its associated blood vessels.



What is the name of blood vessel P, and which molecule is present in higher concentration in P compared to Q?

	name	substrate
A	hepatic portal vein	oxygen
B	hepatic artery	oxygen
C	hepatic portal vein	carbon dioxide
D	hepatic artery	carbon dioxide

33 The statements below are about how the liver deals with excess glucose.

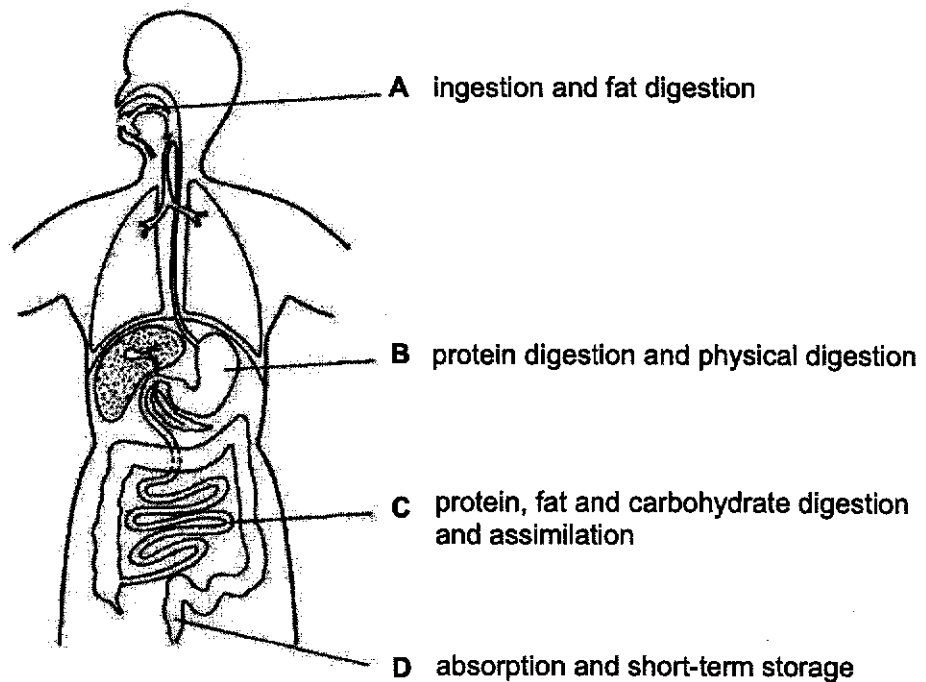
- 1 converted to starch
- 2 deaminated to produce urea
- 3 stored as glycogen

Which statement(s) is/are correct?

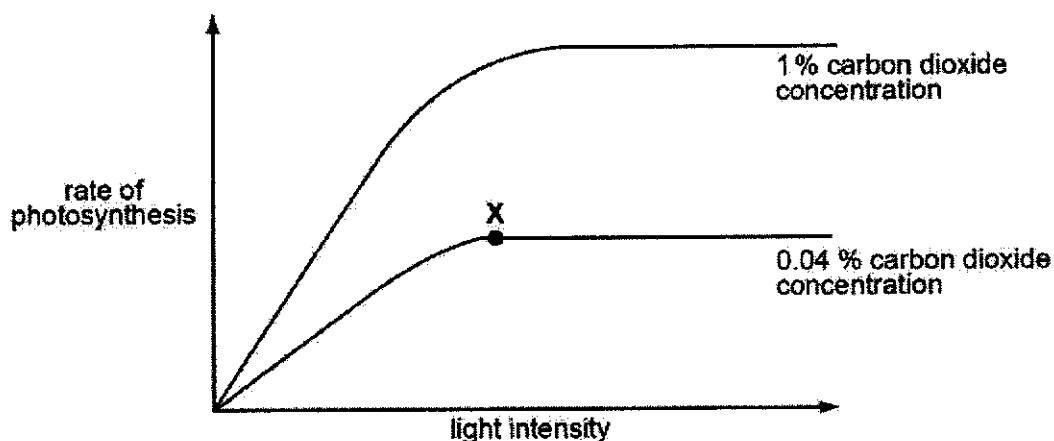
- A 1 and 2 only
- B 1 and 3 only
- C 1, 2 and 3
- D 3 only

34 The diagram shows the human alimentary canal.

Which label correctly describes the functions for that particular part of the alimentary canal?

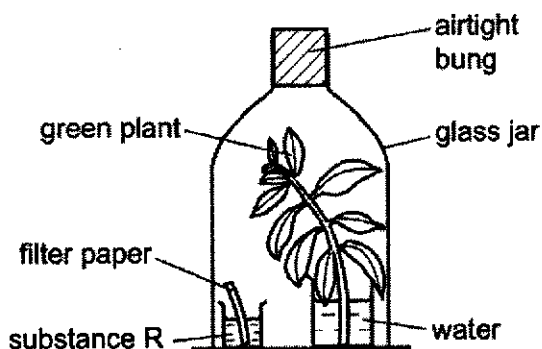


- 35 The graph shows how the rate of photosynthesis in the same plant is affected by light intensity at two different carbon dioxide concentrations. The temperature was kept constant at 30 °C.



Which factor controls the rate of photosynthesis at point X?

- A amount of chlorophyll
 - B availability of water
 - C carbon dioxide concentration
 - D light intensity
- 36 The diagram shows an experimental set-up to investigate if carbon dioxide is needed for photosynthesis.

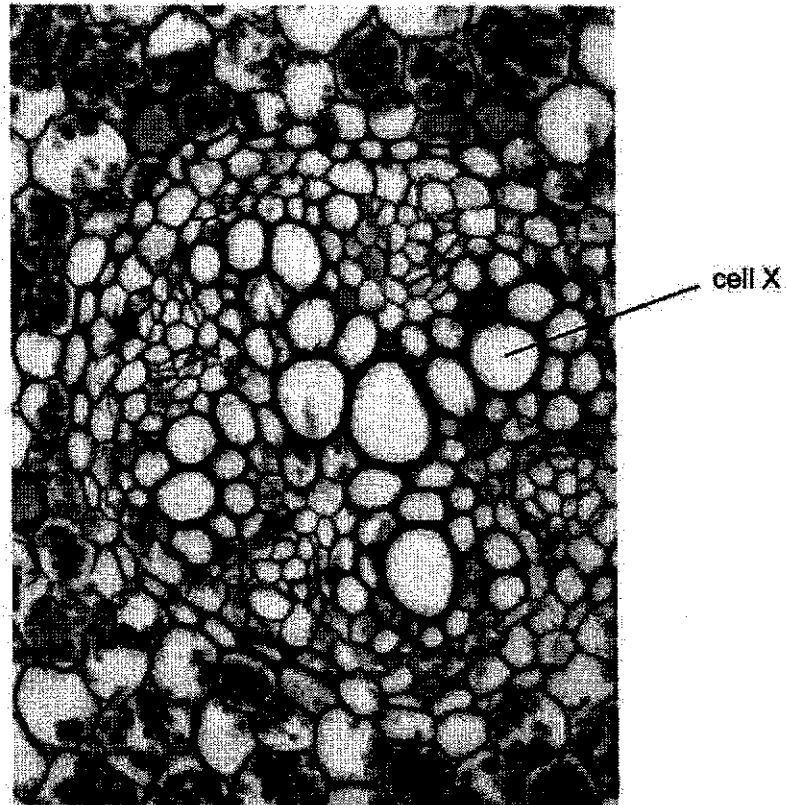


A beaker containing substance R is placed in the glass jar to remove carbon dioxide from the air in the glass jar.

What could substance R be?

- A bleach
- B hydrochloric acid
- C potassium hydroxide solution
- D sodium hydrogen carbonate solution

- 37 The diagram shows part of a section of a root of a plant.

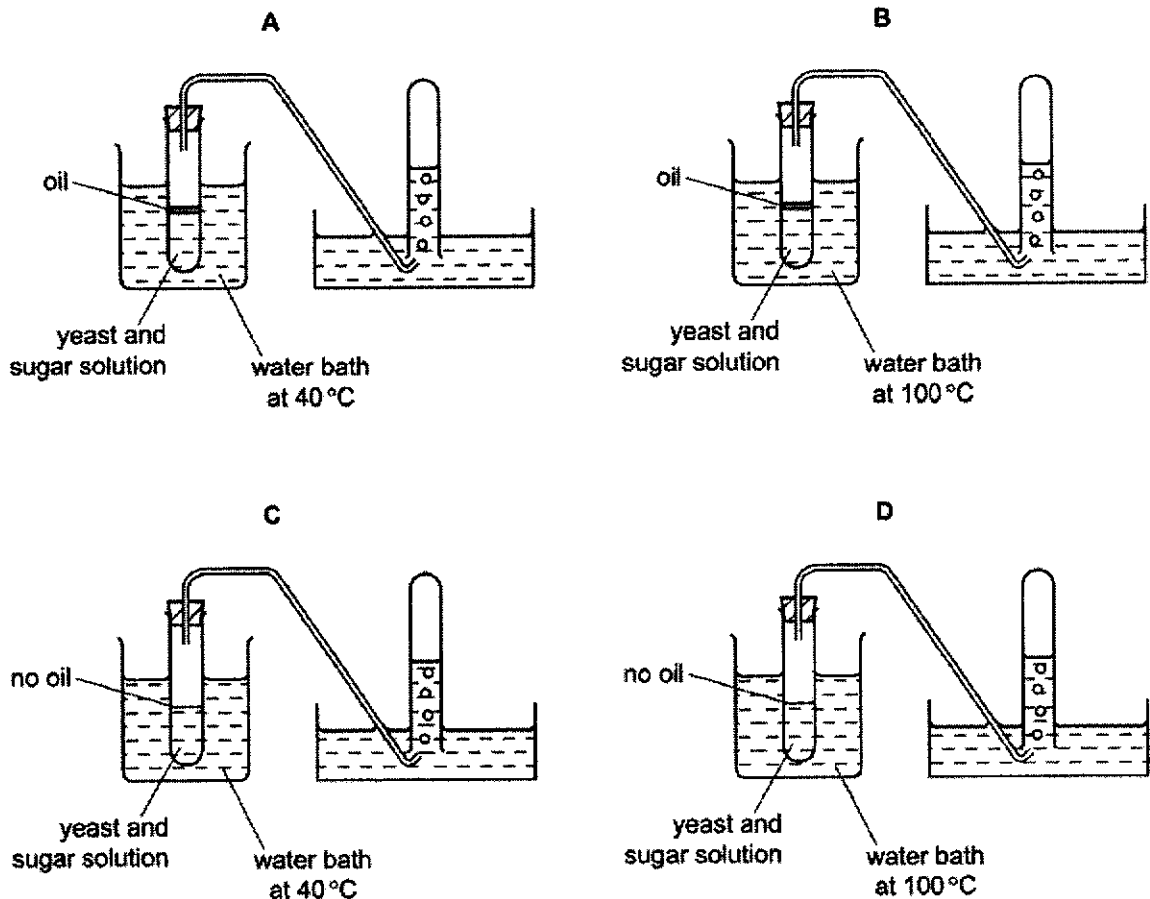


The contents of cell X were tested using Benedict's test and iodine test.

What are the expected results?

	Benedict's test	iodine test
A	brick-red precipitate	blue-black
B	brick-red precipitate	remains brown
C	remains blue	blue-black
D	remains blue	remains brown

- 38 Which apparatus can be used to investigate the production of carbon dioxide by respiration of yeast?



- 39 The three structures below are part of the gaseous exchange system.

- 1 bronchus
- 2 bronchiole
- 3 trachea

What is the order of the structures in which air will enter through during inhalation?

- A 1 → 2 → 3
 - B 2 → 1 → 3
 - C 3 → 1 → 2
 - D 3 → 2 → 1
- 40 Why is a rise in pulse rate important for an athlete during a race?

- A to increase digestion of carbohydrates
- B to increase ventilation of the lungs with fresh air
- C to reduce the need for anaerobic respiration
- D to reduce the need for sweating to cool down the body

END



PASIR RIS CREST SECONDARY SCHOOL
End-of-Year Examination
Secondary Three Express

CANDIDATE
NAME

CLASS

3	/	
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INDEX
NUMBER

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Science (Biology)

Paper 4

5078/04

9 October 2019

1 hour 15 minutes

READ THESE INSTRUCTIONS FIRST

Write your candidate name, class and index number on all the work you hand in.
Write in dark blue or black pen.
You may use a HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Section A (45 marks)

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

Section B (20 marks)

Answer any **two** questions.

Write your answers in the spaces provided.

The use of a scientific calculator is expected, where appropriate.

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

For Examiner's Use	
	65
Parent's Signature	

This document consists of 14 printed pages.

[Turn over

Section A (45 marks)

Answer all questions in the spaces provided.

- 1 Fig. 1.1 shows a short segment of a DNA molecule.

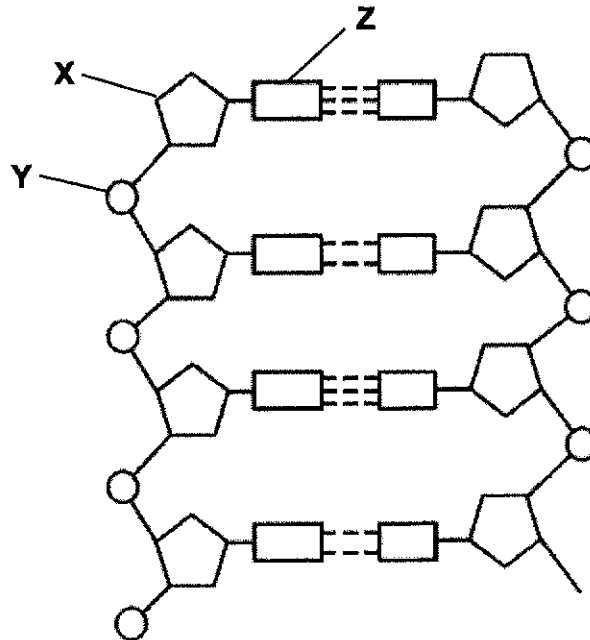


Fig. 1.1

- (a) Name the parts X, Y and Z.

X

Y

Z

[3]

- (b) The chromosome of an insect contains 30.5% of adenine. Using the rule of complementary base pairing in DNA, calculate the percentage composition of thymine, cytosine and guanine in the chromosome of this insect.

.....

.....

.....

[2]

(c) Define the term *gene*.

.....

.....

.....

[2]

[Total: 7]

2 Fig. 2.1 shows the human digestive system.

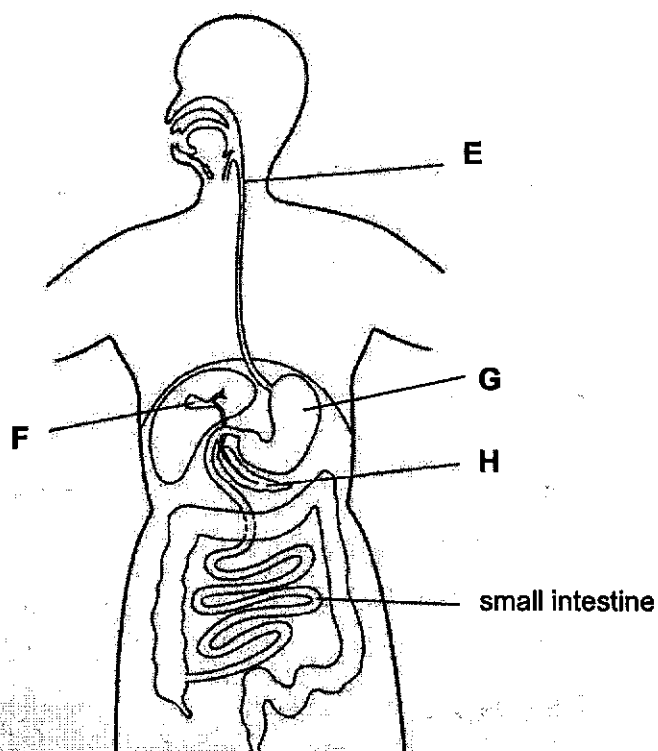


Fig. 2.1

(a) Identify the organs labelled E, F and G.

E

F

G

[3]

[Turn over

- (b) Name organ **H** and describe its role in digestion.

.....
 [2]

- (c) The small intestine is where absorption of digested food occurs.

Describe **three** ways how the small intestine is adapted to perform this function.

1.

2.

3.
 [3]

- (d) Celiac disease is a disease which causes the cells in the small intestine to become inflamed and damaged. Fig. 2.2 shows a comparison between the small intestine lining of a healthy individual and an individual suffering from Celiac disease.

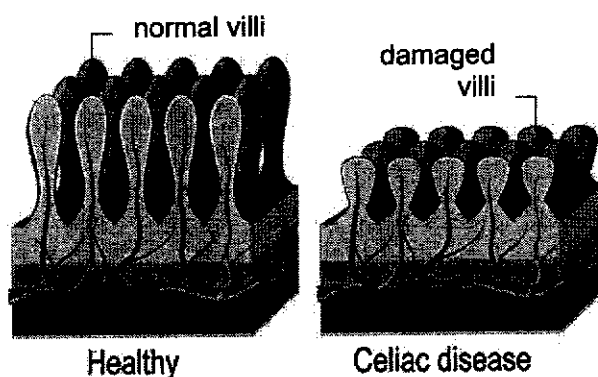


Fig. 2.2

With reference to Fig. 2.2, suggest and explain what will happen to a person suffering from celiac disease.

.....
 [2]
 [Total: 10]

- 3 Fig. 3.1 shows the relationship between temperature and the rate of an enzyme-catalysed reaction.

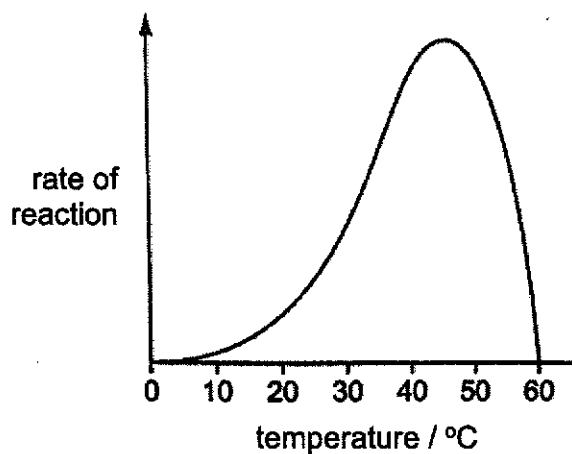


Fig. 3.1

- (a) With reference to Fig. 3.1, describe and explain how the activity of the enzyme is affected by temperature.

.....

.....

.....

.....

[3]

- (b) In the space below, sketch a graph to illustrate the effect of pH on the rate of an enzyme-catalysed reaction.

[2]

[Turn over

- (c) Using the 'lock and key' hypothesis, explain why protease will only digest protein molecules and not other food molecules.

.....

.....

..... [3]

- (d) Complete the table on digestive enzymes in the human alimentary canal.

name of enzyme	site of action	substrate	end-product
salivary amylase			maltose
	duodenum	fat	
	duodenum	maltose	
protease		protein	

[4]

- (e) State the organelle responsible for production of digestive enzymes.

..... [1]

[Total: 13]

- 4 Fig 4.1 shows an alveolus in the lungs.

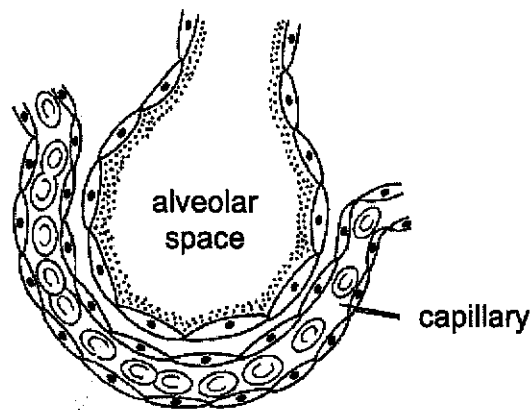


Fig. 4.1

- (a) Describe **two** features of the alveolus that enable fast transfer of oxygen from alveolar space to the bloodstream.

1.

.....

2.

.....

[2]

- (b) On the diagram, draw 2 **arrows** to show the pathway of oxygen into the alveolus and into the bloodstream.

[1]

- (c) Red blood cells transport oxygen to all parts of the body.

Describe and explain **two** ways in which the red blood cell is adapted to carry out this function.

1.

.....

2.

.....

[2]

[Total: 5]

[Turn over

- 5 Fig. 5.1 shows a magnified transverse section through a leaf.

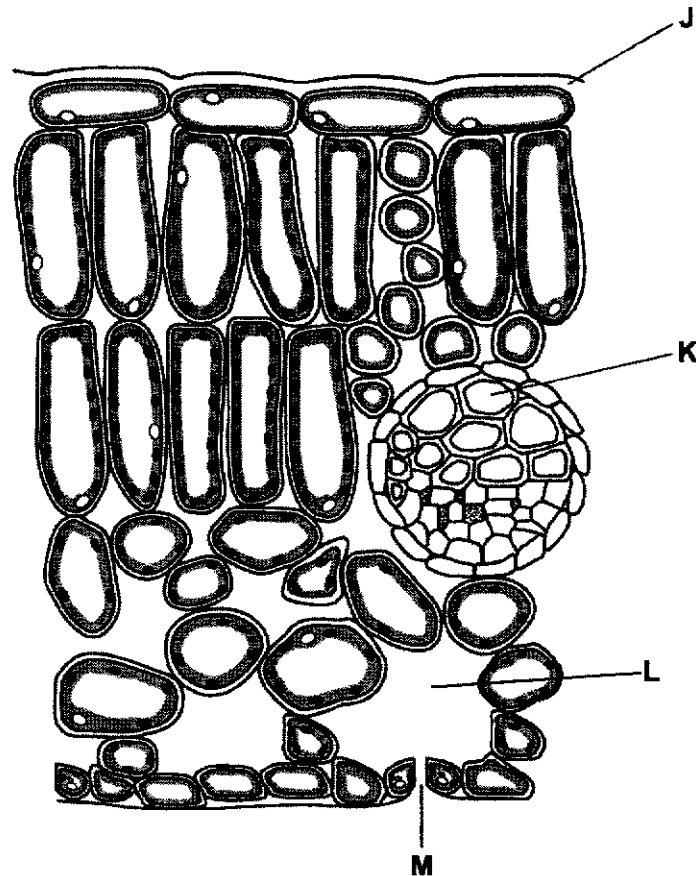


Fig. 5.1

- (a) Identify the parts J, K, L and M.

J [4]
 K
 L
 M

- (b) Explain the significance of parts J and M to prevent wilting.

J [2]

 M

- (c) (i) On Fig. 5.1, draw a line, labelled **N**, through the layer of cells that conduct the most photosynthesis in the leaf. [1]
- (ii) Name these photosynthetic cells.
..... [1]
- (d) The cells in the upper and lower epidermis do not contain chloroplasts. Suggest the significance of this adaptation.
.....
..... [1]
- (e) On Fig. 5.1, name and label the cells responsible for transporting the products of photosynthesis to other parts of the plant. [1]

[Total: 10]

[Turn over]

Section B (20 marks)

Answer any **two** questions in the spaces provided.

- 6** An experiment was conducted to investigate the effect of temperature on the rate of photosynthesis of a plant.

The volume of oxygen released by the plant was measured over fifteen minutes. The experiment was conducted at different temperatures ranging from 10 °C to 45 °C, at increments of 5 °C.

The results are shown in Table 6.1.

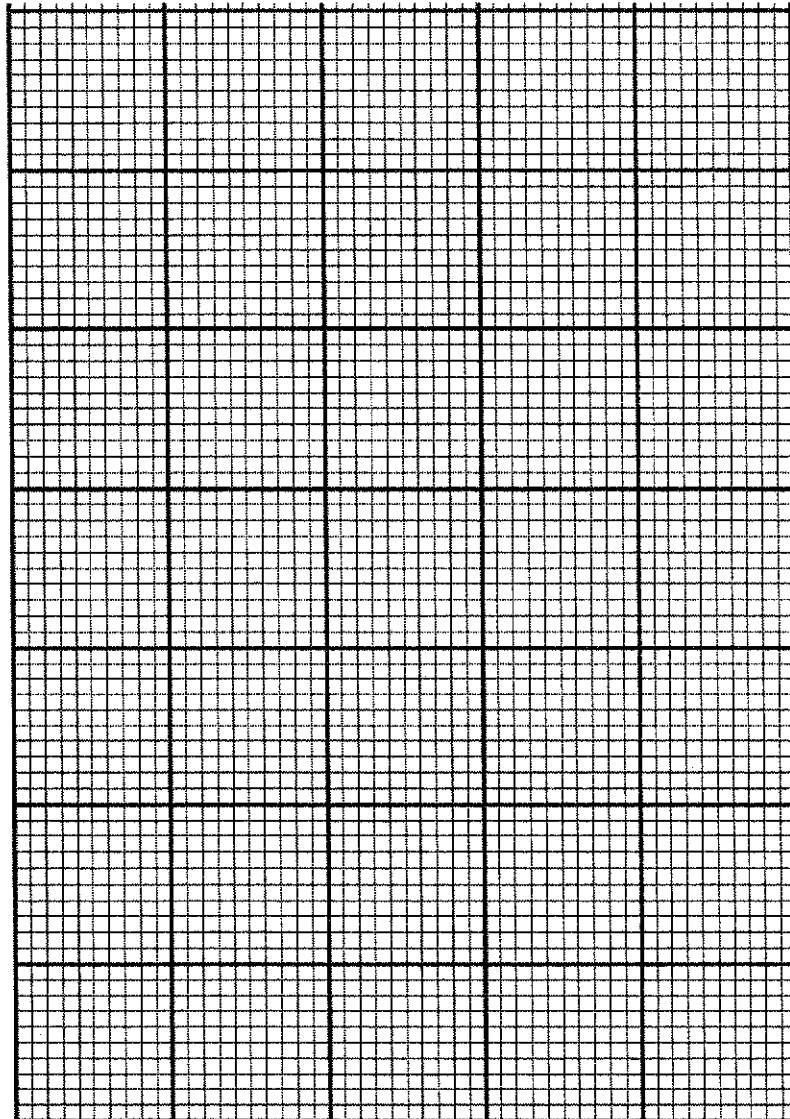
Table 6.1

Temperature / °C	10	15	20	25	30	35	40	45
Volume of oxygen gas / cm ³	9	15	23	31	34	32	19.5	3

- (a) Write the word equation for photosynthesis.

..... [2]

- (b) Draw a graph of volume of oxygen gas produced against temperature in the grid provided using a curved line of best-fit.



[4]

(c) Explain the shape of the graph.

.....

.....

.....

.....

[3]

(d) State **two** other factors that would affect the rate of photosynthesis of this plant.

..... [1]

[Total: 10]

[Turn over

- 7 (a) Describe the pathway of water through a plant from the soil to leaving the leaves.**

[illegible]

[5]

- (b) Describe the appearance of a wilted plant and explain the process of wilting.**

.....

.....

.....

.....

.....

[3]

- (c) State **two** factors that may cause a plant to wilt.

.....

.....

.....

[2]

[Total: 10]

- 8 (a) State the word equation for aerobic respiration.

..... [1]

- (b) Respiration and photosynthesis are cellular processes that involve energy.

Name the organelles in which these processes occur. Suggest links between these two processes.

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

- (c) Living at high altitudes increases the number of red blood cells in a person's blood.

Suggest why athletes sometimes train at high altitudes.

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

[Turn over

(d) Fig. 8.1 shows the volume of air in a person's lungs before and after exercise.

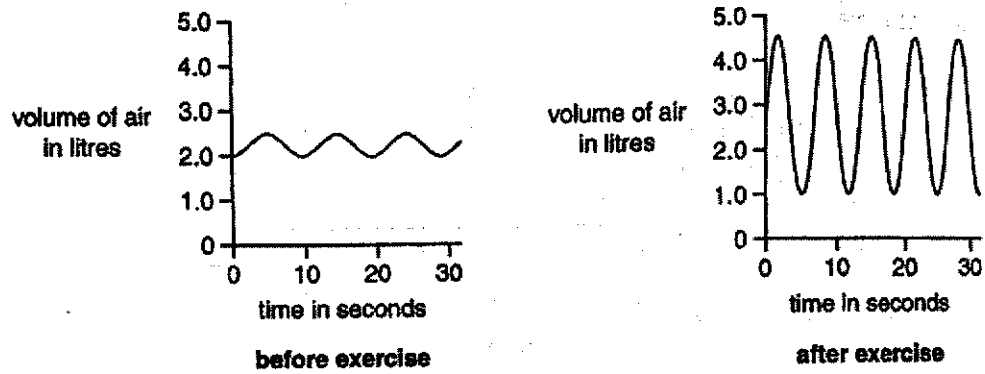


Fig. 8.1

With reference to Fig. 8.1, describe and explain the effect of exercise on the breathing rate of a person.

.....

.....

.....

..... [3]

[Total: 10]

End of Paper 4

Pasir Ris Crest Secondary School
3E Science (Biology) 5078 End-of-Year 2019

Paper 1: Multiple Choice Questions (Total Marks: 20)

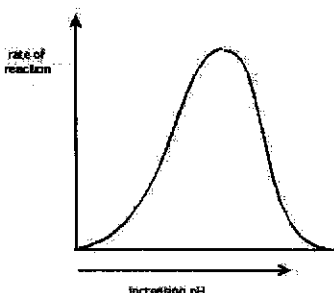
1 mark given to each correct answer.

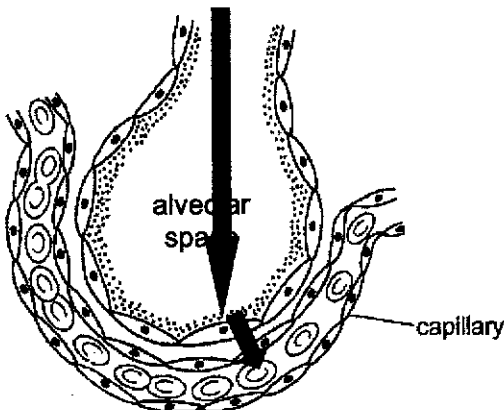
Question No.	Answer	Question No.	Answer
21	C	31	D
22	A	32	C
23	A	33	D
24	A	34	B
25	B	35	C
26	D	36	C
27	D	37	D
28	D	38	C
29	C	39	C
30	B	40	C

Paper 4

Section A (Total Marks: 45)

Qn No.	Answer	Marks
1(a)	X : deoxyribose sugar / pentose sugar Y : phosphate group Z : nitrogenous base <i>Reject: sugar / base</i>	1 1 1
(b)	Thymine: 30.5% ; cytosine: 19.5% ; guanine: 19.5% ; <i>Reject: no units (deduct 1 mark)</i>	1 1
(c)	A gene is a sequence of nucleotides, as part of a DNA molecule / a segment of DNA. A gene is a unit of inheritance which controls the production of a specific polypeptide. <i>Accept: protein</i>	1 1 [total: 7]
2(a)	E oesophagus <i>Reject: gullet</i> F gall bladder G stomach	1 1 1
(b)	Name: pancreas Produces enzymes protease, amylase and lipase <i>(must state names of enzymes)</i>	1 1
(c)	1. The small intestine is <u>long and coiled</u> to provide more time for absorption of nutrients;	Any 3

	2. The inner wall of the small intestine is <u>highly folded</u> to increase surface area for more absorption of nutrients 3. The presence of <u>finger-like projections/ villi</u> that increase surface area for more absorption of nutrients 4. The <u>inner lining of small intestines is one-cell thick</u> to provide shorter diffusion distance for faster absorption of nutrients 5. The presence of <u>microvilli on cells of intestinal lining</u> increases surface area to volume ratio of the cells for faster absorption of nutrients via diffusion																					
(d)	Suggest: the person will suffer from malnutrition/ lose weight/ not get sufficient nutrients/ fall ill due to lack of nutrients / become weak Explain: the person will absorb lesser nutrients / reduced/lesser surface area of villi will result in reduced/lesser absorption of nutrients.	1 1 [total: 10]																				
3(a)	At low temperature (0 °C – 20 °C), the activity of enzyme is <u>low</u> as the enzyme is <u>inactive</u>; As temperature <u>increases to 40 °C</u>, enzyme activity <u>increases</u>; At 40 – 50 °C, enzyme <u>activity is highest</u>, this is the <u>optimum</u> temperature; Beyond 45 °C, enzyme activity drops and eventually stops at 60 °C. Enzymes become <u>denatured</u> at high temperature. (Deduct 1 mark if no data values quoted)	1 1 1																				
(b)		1 - correct shape 1 - axis labelled correctly																				
(c)	Protease has a specific 3D shape; Only protein molecules have a <u>complementary shape</u> to the <u>active site</u> of the enzyme protease. Other food molecules <u>do not have a complementary shape to the active site</u>, thus cannot form the <u>enzyme-substrate</u> complex.	1 1 1 1, any 3																				
(d)	<table><tr><td>name of enzyme</td><td>site of action</td><td>substrate</td><td>end-product</td></tr><tr><td>salivary amylase</td><td>mouth</td><td>starch</td><td>maltose</td></tr><tr><td>lipase</td><td>duodenum</td><td>fat</td><td>Fatty acid and glycerol</td></tr><tr><td>maltase</td><td>duodenum</td><td>maltose</td><td>glucose</td></tr><tr><td>protease</td><td>Stomach/ duodenum/ small intestine</td><td>protein</td><td>polypeptides</td></tr></table>	name of enzyme	site of action	substrate	end-product	salivary amylase	mouth	starch	maltose	lipase	duodenum	fat	Fatty acid and glycerol	maltase	duodenum	maltose	glucose	protease	Stomach/ duodenum/ small intestine	protein	polypeptides	1 1 1 1 1 *both correct
name of enzyme	site of action	substrate	end-product																			
salivary amylase	mouth	starch	maltose																			
lipase	duodenum	fat	Fatty acid and glycerol																			
maltase	duodenum	maltose	glucose																			
protease	Stomach/ duodenum/ small intestine	protein	polypeptides																			
(e)	ribosomes	1 [total: 13]																				

4(a)	1. wall of alveoli are <u>one-cell thick</u> 2. alveoli has a <u>thin layer of moisture</u> on the inner wall 3. alveoli are <u>richly supplied / in close contact with capillaries</u>	Any 2
(b)	 Into space, into thin film of moisture, into red blood cell Accept: if arrow into bloodstream, even though not into rbc	1
(c)	1. <u>biconcave shape</u> provides <u>large surface area to volume ratio</u> for faster <u>diffusion of oxygen</u> 2. <u>lack of nucleus</u> provides <u>more space</u> to store more haemoglobin to transport more oxygen 3. <u>contains haemoglobin</u> which binds reversibly with oxygen to carry it to where it is needed around the body 4. <u>elastic and flexible cell membrane</u> allows the cells to <u>squeeze through narrow blood vessels</u> .	1 1 1 1 (Any 2) [total:10]
5(a)	J Cuticle / waxy cuticle K xylem L Intercellular air space M stoma	1 1 1 1
(b)	J , waxy cuticle <u>prevents loss of water vapour</u> / prevents water loss through evaporation M , stomata will <u>close</u> to prevent loss of <u>water vapour</u> through <u>evaporation</u>	1 1
(c) (i)	*line drawn through <u>palisade mesophyll cells</u> , labelled N	1
(ii)	palisade mesophyll cells	1
(d)	To allow more light to pass through to the mesophyll cells / Accept: as chlorophyll is a metabolically expensive molecule to produce, the cells of the upper and lower epidermis do not contain chloroplasts to protect the inner mesophyll layer.	1
(e)	label phloem cells on diagram	1 [total: 10]

Section B (Total Marks: 20 out of 30)

6(a)	Light energy Carbon dioxide + water $\xrightarrow{\hspace{2cm}}$ glucose + oxygen Chlorophyll <i>Insist on 'light energy', reject: light/ sunlight</i>	1 - conditions 1 - eqn
(b)	Axis labelled Appropriate scale Plotted points accurately Draw best-fit curve	1 1 1 1
(c)	1. At low temperature, rate of photosynthesis is low, as enzymes are <u>inactive</u>; 2. As temperature increases, volume of oxygen collected increases/rate of photosynthesis increases as enzymes become <u>more active</u>; 3. At optimum temperature, <u>highest</u> volume of oxygen gas is collected. 4. Beyond optimum temperature, the volume of oxygen collected drops sharply/ rate of photosynthesis decreases, as enzymes become <u>denatured</u> at high temperatures.	1 1 1 1 (Any 3)
(d)	Light intensity / carbon dioxide concentration / availability of water / amount of chlorophyll	1 (Any 2) [total: 10]

7(a)	1. Water in the soil will enter the <u>root hair cells</u> via <u>osmosis</u>, as the soil has a <u>higher water potential</u> than the cell sap of the root hair cells. 2. Water will move from root hair cell through root cells (from cell to cell) until it reaches the xylem via <u>osmosis</u>. 3. Water travels <u>upwards in the xylem vessels</u>. 4. When <u>water vapour diffuses</u> mainly from the stomata, these (leaf) cells will have lower water potential. 5. <u>Water molecules will move from the xylem vessel into mesophyll cells via osmosis</u>. 6. <u>Water molecules</u> evaporate from the thin film of moisture on the mesophyll cells into the <u>intercellular air spaces</u>. 7. When stomata are open, <u>water vapour will diffuse out of the stomata</u> to the surroundings where there is a lower concentration of water vapour. 8. <u>Loss of water vapour from the leaves creates transpiration pull</u>. <i>Note: water molecules move via osmosis, water vapour move via diffusion</i>	Any 5
(b)	D: When a plant wilts, the <u>leaves will droop/ curl inwards</u> E: When leaf cells <u>lose water</u> via transpiration at a faster rate than water can be <u>absorbed</u> from the roots. Vacuoles in leaf cells will shrink; the cells <u>lose turgor pressure/ become plasmolysed(flaccid)/ lose turgidity</u>; Plasmolysed(Flaccid) cells can no longer provide <u>support</u> for the leaf so the leaf will droop/ curl inwards.	1 1 1 1 [max 3]
(c)	1. High light intensity / strong sunlight 2. Dry weather / low humidity 3. High temperature / hot day 4. Windy day / wind	Any 2 [total: 10]

8(a)	Glucose + oxygen → carbon dioxide + water (<i>energy is released</i>)	1
(b)	<u>Chloroplasts</u> conduct photosynthesis <u>Mitochondria</u> conduct respiration 1. Photosynthesis absorbs/requires light energy and converts it into chemical energy in glucose, respiration releases energy from the chemical energy stored in glucose 2. Photosynthesis makes glucose while respiration uses glucose (made from photosynthesis) 3. Oxygen produced in photosynthesis is used up in respiration 4. Carbon dioxide/water is used in photosynthesis and is released during respiration 5. Glucose molecules are made and stored in photosynthesis while respiration uses up glucose molecules. <i>Reject: differences that have no link, e.g. photosynthesis occurs in cells with chloroplasts, respiration happens in all cells. Or photosynthesis occurs in plants while respiration happens in plants and animals. Etc.</i>	1 – for both Any 3
(c)	Athletes train at high altitudes to increase number of red blood cells in their blood. More red blood cells will <u>increase the amount of oxygen</u> that can be transported at any one time; Thus, muscles can conduct <u>higher rate of respiration</u>; to release <u>more energy</u>.	(any two) 1 1 1
(d)	D: After exercise, the <u>breathing rate of a person increases/ becomes faster/ almost doubles</u>; 3 breaths in 30 s before exercise, compared to 5 breaths in 30 s after exercise; OR The <u>volume of air per breath increases</u> from 0.5 litres before exercise to 3.5 litres per breath after exercise. E: This is because during exercise, the muscles require <u>more oxygen</u>; for <u>increased rate of respiration</u> to provide <u>more energy to the muscles</u>; Breathing rate will increase to provide more oxygen and also <u>to remove the carbon dioxide released as a waste product of respiration</u>.	1 OR 1 1 1 OR 1 (max 3) [total: 10]

END