NAME:	NO:	CLASS:

ADMIRALTY SECONDARY SCHOOL

END OF YEAR EXAMINATION 2019

SUBJECT	:	Science (Biology)
CODE/PAPER	:	5078/01
LEVEL/STREAM	:	Secondary 3 Express
DATE	:	9 October 2019
TIME	:	0800 h – 0930 h
DURATION	:	1 hour 30 minutes

Instructions to candidates:
Write your name, index number and class on the cover page.
Write in dark blue or black pen.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A: Multiple choice questions [20 marks]
Answer all questions in the OTAS provided.

Section B: Short answer questions [30 marks]
Answer all questions. Write your answers in the spaces provided in the question paper.

Section C: Structured questions [20 marks]
Answer any 2 out of three questions. Write your answers in the writing papers provided.
Submit the question paper, OTAS and writing papers separately.

Candidates are reminded that all quantitative answers should include appropriate units.
The use of an approved 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	
Section A	/ 20
Section B	/ 30
Section C	/ 20
Total	/ 70

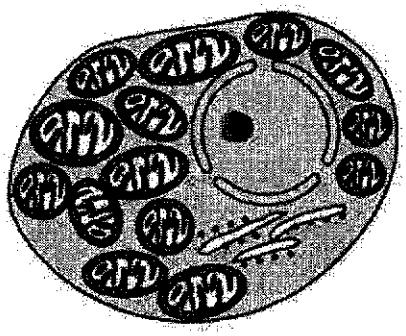
DO NOT TURN OVER THIS PAPER UNTIL YOU ARE TOLD TO DO SO.

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

Section A

Answer all questions.

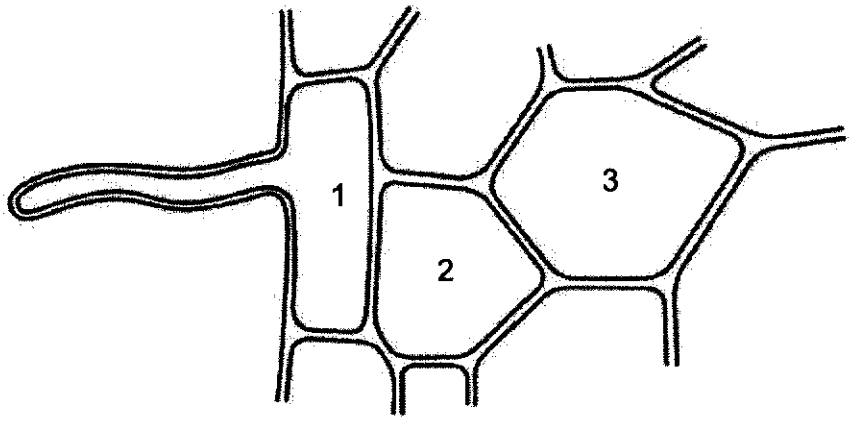
1 Examine the following animal cell.



Based on the structure shown, which of the following statements best describes the need or the main activity that occur within the cell?

A The cell produces large amount of enzymes.
B The cell produces large amount of urea.
C The cell requires high levels of oxygen.
D The cell undergoes photosynthesis.

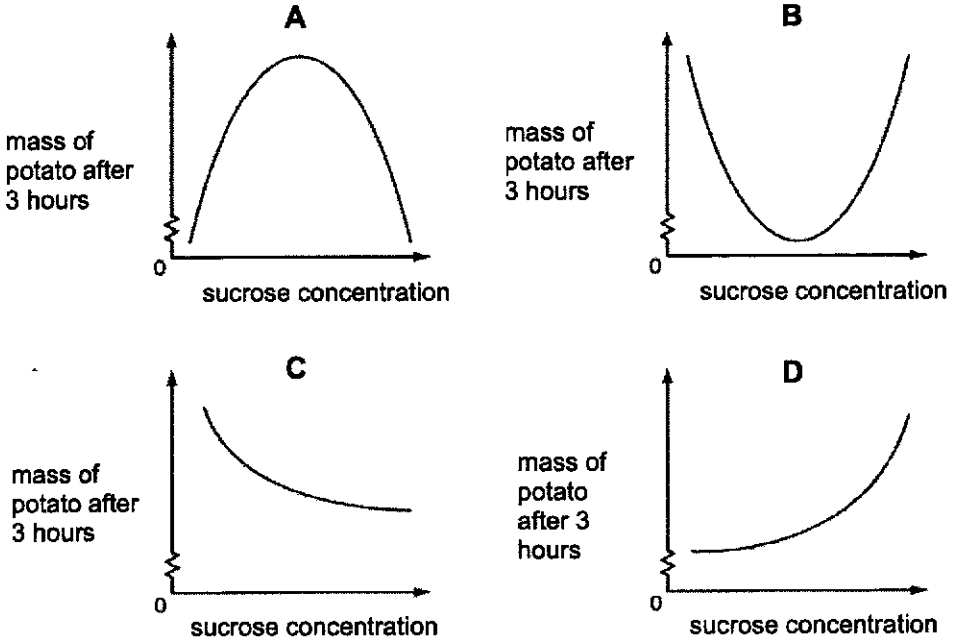
2 The diagram shows some cells in the root of a plant that is absorbing water from the soil.



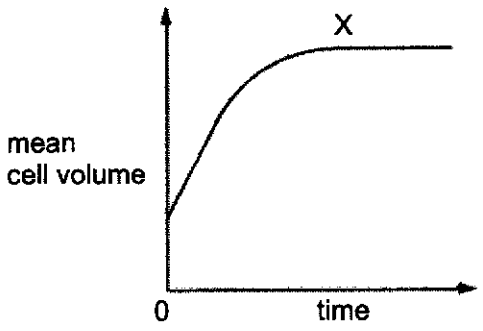
How does the water potential of the cell marked 2 differ from the water potentials of the cells marked 1 and 3?

A higher than cell 1 and cell 3
B higher than cell 1 and lower than cell 3
C lower than cell 1 and higher than cell 3
D lower than cell 1 and lower than cell 3

3 Identical pieces of potato are placed in sucrose of different concentrations. After three hours, the mass of each potato is measured. Which graph shows the results of this experiment?



4 A tissue composed of plasmolysed plant cells was placed in distilled water. The graph shows how the mean cell volume changes with time.



Which conclusion can be made at X?

1 water potential in the plant cell has become lower
2 cells have become fully turgid
3 no net movement of water into the cells

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

5 Four test tubes containing egg white were incubated for ten minutes at 35 °C.
Different substances are then added into the test tubes.
In which test tube is egg white first digested?

	substance added
A	1 cm^3 of lipase solution and three drops of sodium hydroxide solution
B	1 cm^3 of protease solution and three drops of dilute hydrochloric acid
C	1 cm^3 of protease solution and three drops of water
D	1 cm^3 of lipase solution and three drops of water

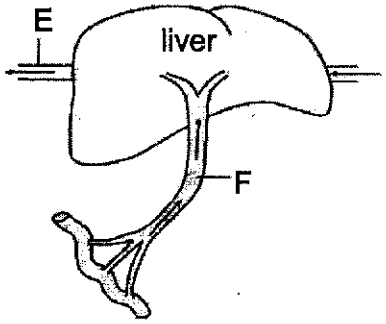
6 The table shows the results of tests carried out on a sample of food.

test	result
biuret	violet colour
Benedict's	blue colour
ethanol emulsion	white emulsion formed
iodine	yellow colour

Which nutrients does the food sample contain?

A fat and protein
B protein and reducing sugar
C reducing sugar and starch
D starch and fat

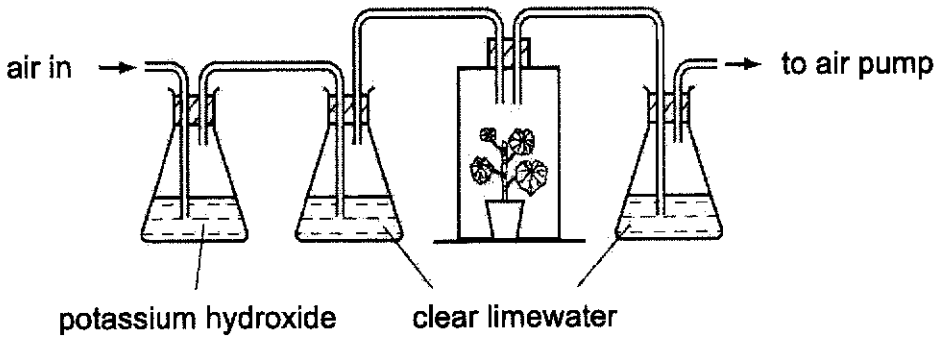
7 The following diagram shows part of the human digestive system.



What would be the expected difference between the concentration of glucose in vessels E and F following a rich meal in starch?

A E and F would have an equal concentration of glucose.
B E would have a higher concentration of glucose than F.
C F would have a higher concentration of glucose than E.
D The concentration of glucose in E and F would be negligible.

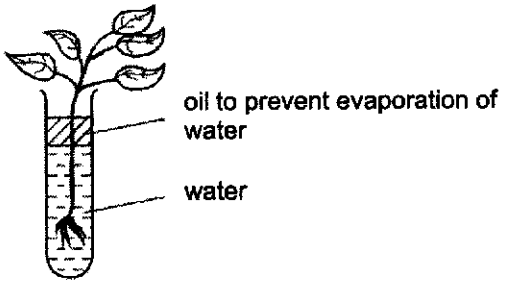
8 The apparatus in the diagram is used to investigate whether carbon dioxide is given off by a green plant.



Which precaution is not necessary?

A enclosing the pot and soil in a sealed plastic bag
B placing the plant in the dark before the experiment
C putting a light proof cover (shade) over the plant during the experiment
D using fresh limewater

9 Five similar plants are placed in test tubes as shown.



Some of the plants have their leaves coated with grease to reduce transpiration. Each plant is weighed in its test tube at the start of the experiment and again two days later.

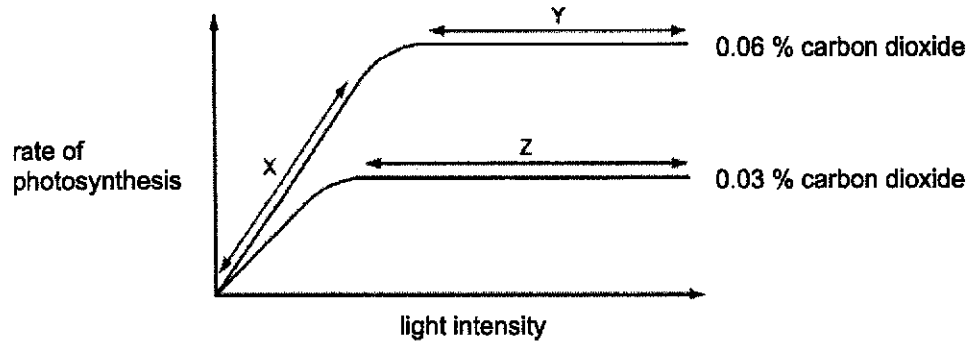
The results are shown in the table.

	mass /g				
	plant 1	plant 2	plant 3	plant 4	plant 5
at start of experiment	105	121	107	111	119
after two days	103	97	84	110	93

Which plants had their leaves coated with grease?

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

10 The graph shows the rate of photosynthesis of a plant at increasing light intensities at two different carbon dioxide concentrations. The temperature is kept constant.



What may be limiting the rate of photosynthesis at X, Y and Z?

	X	Y	Z
A	carbon dioxide	light intensity	carbon dioxide
B	carbon dioxide	light intensity	light intensity
C	light intensity	carbon dioxide	carbon dioxide
D	light intensity	carbon dioxide	light intensity

11 What is the definition of translocation?

A The transport of sugars and amino acids in phloem tissue.
B The transport of water and mineral salts in phloem tissue.
C The loss of water from the surfaces of a plant.
D The loss of water through the stomata of a plant.

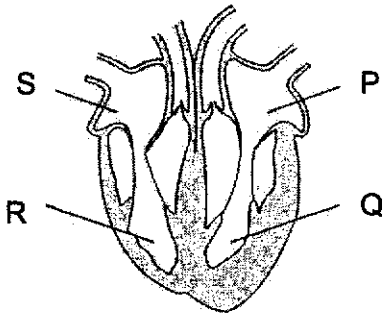
12 When John fell down and cut his knee, these events take place in the wound.

1 fibrinogen is converted into fibrin
2 formation of a network of fibrin threads
3 platelet and damaged tissue release an enzyme
4 red blood cells and platelets are trapped

Which shows the correct order of these events?

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

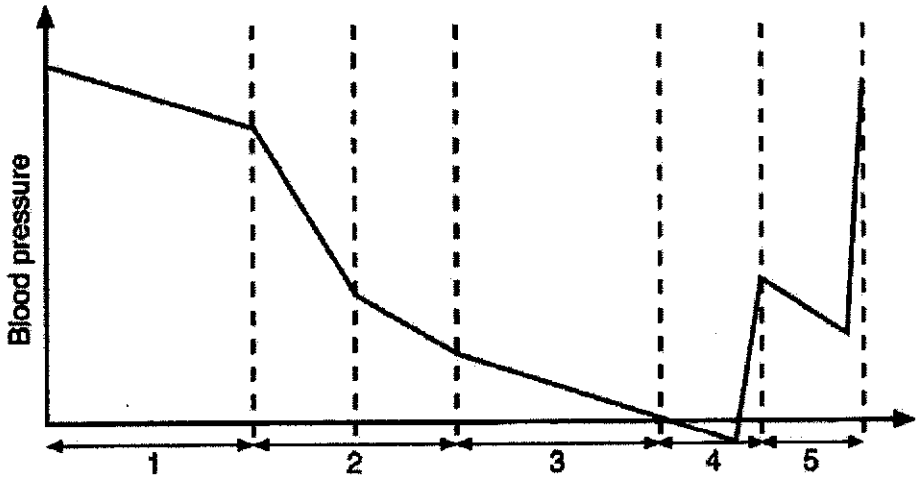
13 The diagram shows the four chambers of a human heart.



Which statement is correct?

A Blood enters P directly from the lungs.
B Blood enters S directly from the lungs.
C Blood passes directly from Q to P.
D Blood passes directly from Q to the lungs.

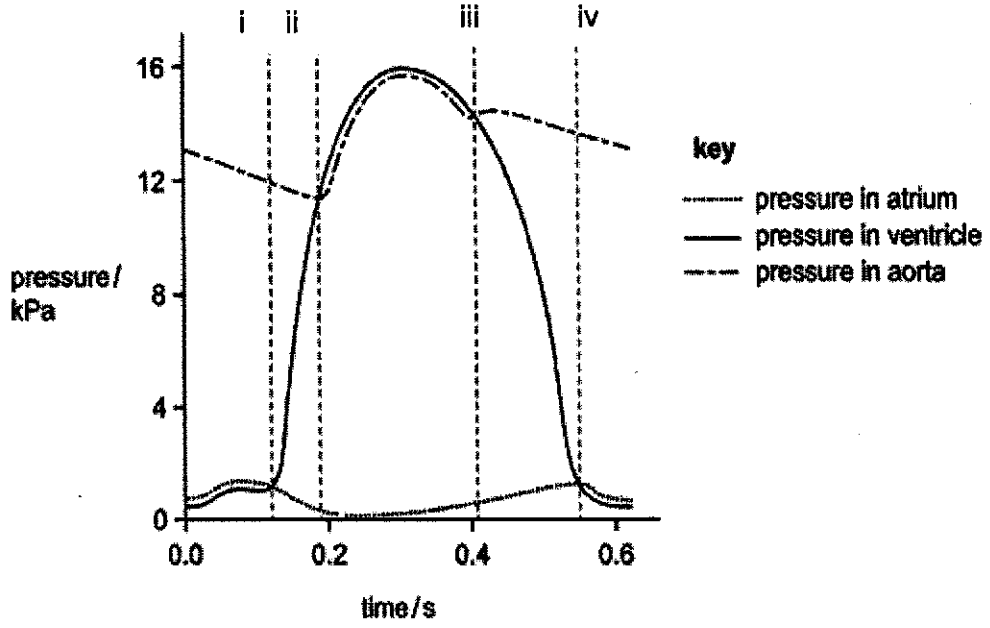
14 The graph below shows the mean blood pressure in various vessels in the human circulatory system.



Which of the following gives the correct names of 1, 2, 3, 4 and 5 on the graph?

	1	2	3	4	5
A	arteries	capillaries	veins	vena cava	pulmonary artery
B	arteries	pulmonary artery	capillaries	vena cava	veins
C	arteries	veins	pulmonary artery	capillaries	vena cava
D	arteries	vena cava	capillaries	pulmonary artery	veins

15 The graph shows pressure changes in the left side of the heart, during a single heartbeat. At which two points do the semi lunar valves open and the bicuspid valves open?



A i and ii respectively
B ii and iii respectively
C ii and iv respectively
D i and iii respectively

16 When yeast respires anaerobically, which substance is used and which substance is produced?

	substance used	substance produced
A	alcohol	carbon dioxide and water
B	alcohol	lactic acid and water
C	glucose	alcohol and carbon dioxide
D	glucose	carbon dioxide and water

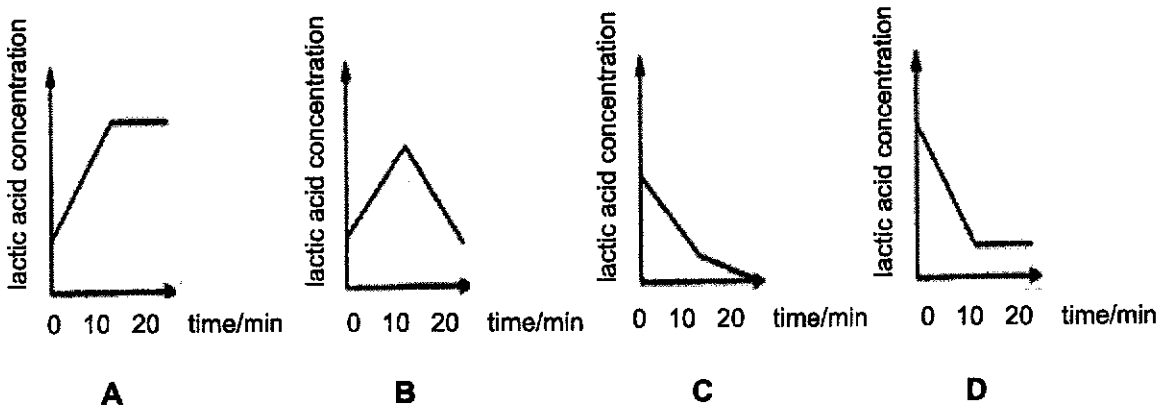
17 The table shows the percentage composition of oxygen, carbon dioxide and water vapour of four samples of air. Which sample is most likely to have come from an individual shortly after vigorous exercise?

	oxygen(%)	carbon dioxide (%)	water vapour
A	21	0.03	high
B	19	0.3	low
C	13	6.2	high
D	21	6.2	low

18 In which order would carbon dioxide molecules pass through the following structures as they leave the human body?

A alveolus, bronchiole, bronchus, larynx, trachea
B alveolus, bronchiole, bronchus, trachea, larynx
C alveolus, bronchus, bronchiole, larynx, trachea
D alveolus, bronchus, bronchiole, trachea, larynx

19 Which graph shows the change of lactic acid concentration in a thigh muscle of a boy if he jumps vigorously for 10 minutes and then sits down for another 10 minutes?



20 The oxygen carrying capacity of the blood of smokers is less than that of non-smokers. Which component of cigarette smoke causes this?

A carbon monoxide
B nicotine
C smoke particles
D tar

Section B

Answer all questions.

1 Fig 1.1 shows an electron micrograph of a cell from the leaf of a corn plant.

Fig. 1.1

(a) In Fig. 1.1, label and name the structures that can be observed when the cell is placed under a light microscope. [3]

(b) **(i)** State a structure in the leaf cell in Fig. 1.1 that is not found in root hair cells.

..... [1]

(ii) Explain how the shape of a root hair cell is adapted for its function.

.....

.....

..... [2]

2 Cellulose is an insoluble carbohydrate. Herbivorous animals like cows, horses and sheep are able to obtain energy from cellulose due to the presence of bacteria in their intestinal tract. These bacteria have the enzyme required to breakdown cellulose.

(a) **(i)** Name the chemical elements present in cellulose.

..... [1]

(ii) State the end-product of cellulose digestion.

..... [1]

(iii) Suggest the name of the enzyme found in the bacteria which breaks down cellulose.

..... [1]

(b) Describe what happens to cellulose in the human alimentary canal.

.....

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..... [2]

3 The Panama disease is a serious disease of bananas caused by a fungus. After gaining entry into a plant, the spores of the fungus gets lodged in the perforated xylem vessel walls that occur at intervals up a plant. The spores germinate and the hyphae grow into the perforations to produce even more spores. The fungus grows rapidly in the whole xylem system and this kills the plant eventually.

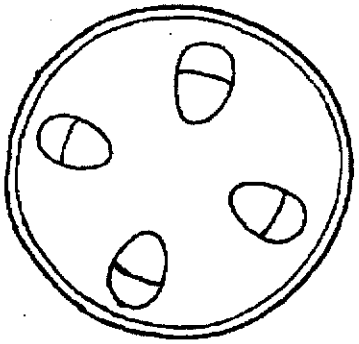

Fig. 3.1

(a) Fig. 3.1 shows the cross section of an infected banana plant stem. Shade all the areas where the spores of the fungus can grow in. [1]

(b) Suggest how the spores gain entry into the plant.

.....

..... [1]

(c) State the possible appearance of a plant that is severely infected by the disease.

.....

..... [1]

(d) Explain how the growth of the fungus in the xylem system can eventually kill the plant.

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..... [3]

4 A student ate several types of bread to see which tasted the best. His observations are shown in Fig. 4.1.

bread types	observations
wholemeal	harder than cornmeal; tastes slightly sweet after 5 minutes
white	soft; tastes sweet when left in the mouth without chewing
rye	harder than wholemeal; chewy with only a slight taste of sweetness after chewing for 5 minutes
cornmeal	harder than white bread; tastes sweet after chewing for 1 minute

Fig. 4.1

(a) Arrange the different types of bread in order of increasing ease of digestion.

..... [1]

hardest easiest

(b) Explain how you arrived at your answer in **(a)**.

.....

.....

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..... [3]

(c) Explain why chewing a piece of chicken meat would not result in the chicken meat tasting sweet.

.....

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..... [2]

(d) The liver is responsible for the regulation of the products of digestion. How does the liver aid the body in regulating blood glucose concentration after a heavy meal of carbohydrate?

.....

.....

..... [2]

5 Jerry was down with a respiratory infection caused by bacteria. During his visit to the clinic, the doctor advised him to soak his toothbrush in salt water to kill the bacteria present on the toothbrush.

(a) Explain how the doctor's advice helps to kill the bacteria present on the toothbrush.

.....

.....

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..... [3]

(b) Suggest and explain another method Jerry can use to kill the bacteria found on the toothbrush.

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..... [2]

Section C

Answer two out of three questions.

6 Fig. 6.1 shows the concentration of oxygen in blood samples, A, B, C and D from four blood vessels in the human circulatory system.

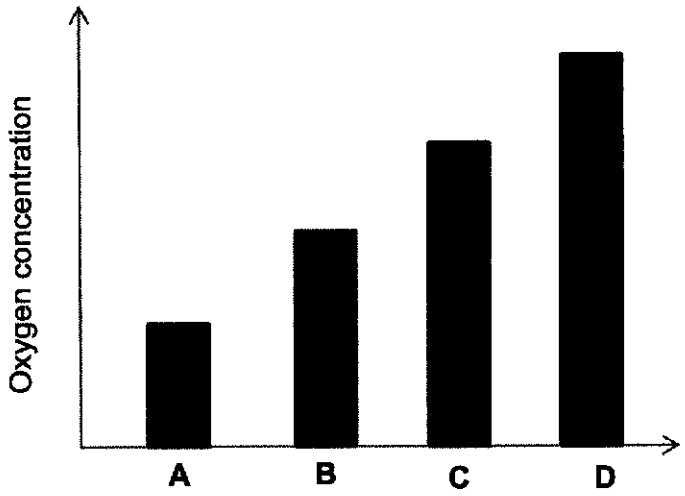

Fig. 6.1

(a) Which of the following blood sample is taken from the pulmonary artery? Explain your answer.

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..... [2]

(b) The secret to winning the gold medal for long distance running in Olympics is to train at high altitudes (very low oxygen content) many months before the competition. Explain how this method gives the athletes a competitive edge over others.

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..... [4]

Fig. 6.2 show how a blocked blood vessel in the heart can be by-passed using an artificial blood vessel.

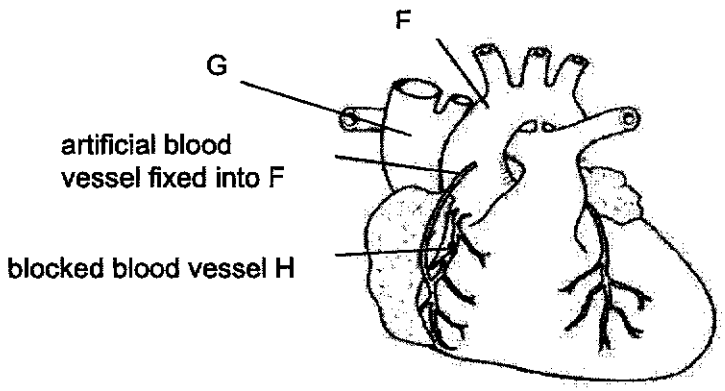

Fig. 6.2

(c) F transports blood to all parts of the body. H is a blood vessel that delivers blood specifically to the cardiac (heart) muscle from F.

Identify H. Explain what happens if H is blocked.

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..... [2]

(d) Using ideas about structure of veins, suggest and explain why a vein might not be suitable for the surgery.

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..... [2]

7 Sarah performed experiments studying the effect of light intensity on the rate of photosynthesis of a green plant which is exposed to different temperatures and carbon dioxide concentrations. Fig. 7.1 shows the results of the experiments.

light intensity/ arbitrary units	rate of photosynthesis/arbitrary units		
	experiment 1 (30 °C, 0.02 % CO_2)	experiment 2 (20°C, 0.5 % CO_2)	experiment 3 (30 °C, 0.5 % CO_2)
2	2	2	2
4	3	5	7
6	3	5	10
8	3	5	12
10	3	5	12
12	3	5	12

Fig. 7.1

(a) Plot the data of experiment 1, 2 and 3 on the same graph paper provided. [2]

(b) Experiment 1 was obtained when the experiment was performed with 0.02 % carbon dioxide present in the environment.

(i) At what light intensity was the highest rate of photosynthesis attained? What is the limiting factor to this point?

.....

.....

..... [2]

(ii) What happens to the rate of photosynthesis beyond the point in **b(i)**? Explain your answer.

.....

.....

..... [2]

(c) Experiment 2 was obtained when the experiment was performed at 20 °C and 0.5 % CO_2. Comparing to Experiment 1, describe the difference in rates of photosynthesis when the light intensity is 4 units. Show your calculation.

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..... [2]

(d) Experiment 3 was obtained when the experiment was performed at 30 °C and 0.5 % CO_2. Explain how temperature affects the rate of photosynthesis.

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..... [2]

8 Fig. 8.1 shows an alveolus and a nearby capillary in a human lung.

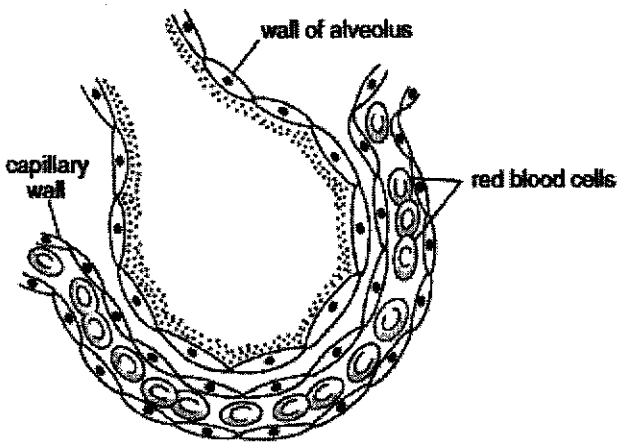

Fig. 8.1

(a) (i) Using ideas of concentration gradient, describe how the exchange of oxygen takes place in the alveolus.

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..... [2]

(ii) Explain how the structure of the alveoli enables this process to take place rapidly.

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..... [3]

(b) Compare the processes of aerobic and anaerobic respiration in humans. State the circumstance under which anaerobic respiration may occur in human muscle tissue.

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..... [5]

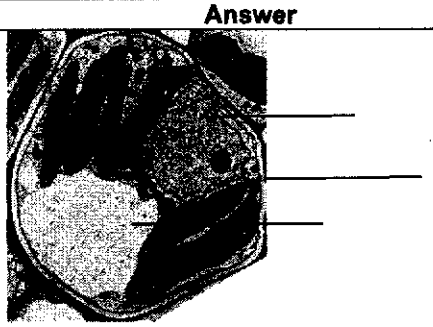
END OF PAPER

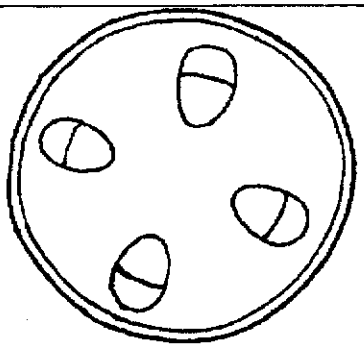
Type of exam:	End-Of-Year-Examination 2019	**Name of setters:**	Jocelyn Goh
Level/Stream:	3 Express Science Biology	**Class(es):**	3E1, 3E2, 3E3

SECTION A

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

SECTION B

Q.		Answer	Marks	Remarks
1	(a)	 structures + label: nucleus, chloroplast, vacuole, cell membrane, cell wall, cytoplasm Any 3 structures for 3m	[1] each to correct label and name	
	(bi)	chloroplast	[1]	
	(bii)	Long/ elongated [1] to increase surface area to volume ratio for faster absorption of water and mineral salts [1] OR Thin walls [1] to decrease time for absorption of water and mineral salts [1]	[2]	
2	(ai)	carbon, hydrogen and oxygen	[1]	
	(aii)	Glucose	[1]	
	(aiii)	cellulase	[1]	
	(b)	Cellulose is <u>not digested along the alimentary canal</u>./ It <u>forms the bulk of undigested materials.</u> It is <u>egested/removed as faeces</u> from the anus. [1]	[1] [1]	

3	(a)	 xylem vessels shaded	[1]	
	(b)	From the water that it absorbed from the soil	[1]	
	(c)	Plant wilt or leaves shrivel up	[1]	
	(d)	Water unable to be transported up the xylem vessel so no water available which is an essential component in photosynthesis. Plant unable to make food so will die. No mineral salts absorbed too so plants will have deficiency in minerals for proper plant growth No water transported means there is no evaporation of water from the cells in the leaves to removes latent heat of vaporisation to cool the plant.	[1] [1] [1]	
4	(a)	rye, wholemeal, cornmeal, white	[1]	
	(b)	Salivary amylase will digest starch to glucose. The faster/ earlier the person taste the sweetness, the faster the digestion Rye is also the hardest so requires more saliva to soften the food for ease of digestion.	[1] [1] [1]	
	(c)	Chicken meat contains proteins. No protease present in the mouth to digest proteins. Amino acids do not taste sweet.	[1] [1]	
	(d)	When there is a high concentration of glucose in blood, the liver uses insulin to convert glucose into glycogen for storage.	[1] [1]	
5	(a)	The salt water has lower water potential than the bacteria. Water leaves the bacteria via osmosis. Bacteria becomes crenated/plasmolyse.	[1] [1] [1]	

	(b)	Place in boiling water / in strong acid or alkaline solution the enzymes/proteins in the bacteria denatures / cell membrane is destroyed Hence the bacteria are unable to survive.	[1] [1]	
6	(a)	Blood sample A. pulmonary artery carries deoxygenated blood from the right ventricle to the lungs so it should contain the least amount of oxygen.	[1] [1]	
	(b)	At high altitude, there is low oxygen content. The body cannot obtain sufficient oxygen to maintain its metabolic rate. Hence the body will make more new red blood cells to compensate for the lower concentration of oxygen. Increasing the proportion of red blood cells also increases the haemoglobin content per unit volume of blood. This means that more blood can be transported per unit time. When the athletes go back to sea level altitude, with the increased volume of haemoglobin, they are able to transport more oxygen to the muscles faster and more efficiently and hence have a longer endurance and better chance in winning.	[1] [1] [1] [1]	
	(c)	H is the coronary artery Blood supply to heart/cardiac muscles will be greatly reduced, leading to heart attack;	[1] [1]	
	(d)	Veins are less muscular high pressure of blood from aorta may cause the veins to burst/veins unable to withstand high blood pressure from aorta ; OR Presence of semilunar valves may block the flow of blood if inserted wrongly	[1] [1] [1] [1]	
7	(a)	Correct plots-1, correct axis- [1]		
	(bi)	Light intensity: 4 units[1] Limiting factor: Light intensity[1]		
	(bii)	The rate does not continue to increase any more	[1]	

<table>
<tr><td></td><td></td><td>The amount of light that gives off maximum rate at 0.02% carbon dioxide has already been reached.[1]
Light is no longer the limiting factor.[1]
[Max:2]</td><td>[1]

[1]</td><td></td></tr>
<tr><td></td><td>(c)</td><td>Rate of photosynthesis for Experiment 2 is faster than that of Experiment 1
(5-3)= 2 arbitrary units.</td><td>[1]

[1]</td><td></td></tr>
<tr><td></td><td>(d)</td><td>When the temperature increased from 20°C to 30°C with the same concentration of carbon dioxide, 0.5%, the enzyme in the plant become more active
increasing the rate of photosynthesis</td><td>

[1]
[1]</td><td></td></tr>
<tr><td>8</td><td>(ai)</td><td>Oxygen diffuses across alveolus wall into bloodstream
down a concentration gradient/ from higher concentration in alveolus to lower concentration in bloodstream</td><td>[1]

[1]</td><td></td></tr>
<tr><td></td><td>(aii)</td><td>Thin wall of alveolus + reduces diffusion distance for gases
numerous alveoli hence increases surface area:volume ratio for faster diffusion of gases
Thin film of moisture so this allows gases to dissolve</td><td>[1]

[1]

[1]</td><td></td></tr>
<tr><td></td><td>(b)</td><td>
<table>
<tr><td>Anaerobic Respiration</td><td>Aerobic Respiration</td></tr>
<tr><td>Occurs in the absence of oxygen</td><td>Occurs in the presence of oxygen</td></tr>
<tr><td>Releases very little energy per unit of food</td><td>Releases more energy per unit of food</td></tr>
<tr><td>Products of anaerobic respiration is lactic acid</td><td>Products of aerobic respiration is carbon dioxide and water</td></tr>
</table>
When there is insufficient oxygen to meet the demands of vigorous muscular contractions, the muscle cells will undergo anaerobic respiration to obtain the extra energy.</td><td>[1]

[1]

[1]

[1]

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