ZHONGHUA SECUNDARY SCHOOL

ZHONGHUA SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2019

SECONDARY 4E

Candidate's Name	Class	Register Number
	4E4	
BIOLOGY		6093 /02

19 September 2019 1 hour 45 minutes

Additional Materials:

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class in the spaces at the top of this page and on all separate answer paper used.

Write in dark blue or black pen.

You may use a pencil for any diagrams, graphs or rough working.

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

Section A

Answer all questions.

Write your answers in the spaces provided on the question paper

Section B

Answer all **three** questions, the last question is in the form either/or. Write your answers in the spaces provided on the question paper.

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

At the end of the examination, fasten all your work securely together.

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

All essential working must be shown clearly.

Setter: Ms Rozianna Vetter: Mr Goh Tze Mian

This document consists of 18 printed pages, including this cover page.



Section A Answer **all** the questions. Write your answers in the spaces provided on the question paper.

1 Large trees produce sun leaves on the outside of the canopy and shade leaves inside the canopy.

Fig. 1.1 shows the rate of carbon dioxide uptake or production of a sun leaf and a shade leaf when exposed to increasing light intensity.



- (a) Draw a line and letter X to label the light intensity at which the rate of respiration is equal to the rate of photosynthesis in the shade leaf on Fig. 1.1. [1]
- (b) With reference to Fig. 1.1, describe two ways in which the sun and shade leaf differ in their response to increasing light intensity.

1				
2				
				 [2]
	Total marks			
			-	
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	549			

2 Fig.2.1 shows the series of events in a cardiac cycle of a man.

The outer ring of the circle (A to H) represents the sequence of events in the ventricles, while the inner ring (a to h) represents events in the atria.

Fig. 2.1

(a) Calculate the heart rate of the man in beats per minute. Show your working.

Iden	tify the period (A to H), at which	
(i)	blood flows from the atria into the ventricles	[1]
(ii)	the semi-lunar valves close	[1]
Desc	cribe the events that occur in the heart during the period A to C .	
		[3]
-	Iden (i) (ii) Dese	Identify the period (A to H), at which (i) blood flows from the atria into the ventricles (ii) the semi-lunar valves close Describe the events that occur in the heart during the period A to C.

(d) An atrial septal defect is a condition where there is a small hole found in the wall of the heart between the left and right atria.

Suggest why doctors advise patients with atrial septal defect to avoid vigorous sports.

[1]

[1]

[Total: 7]

3 Table 3 shows the clearance time of some substances for a patient undergoing kidney dialysis.

substance in blood	concentration in blood / mg/l			
	time = 0 h	time = 0.5 h	time = 6 h	
urea	176	144	126	
creatinine	3.4	2.7	2.5	
glucose	134	128	138	
potassium	4.3	4.1	4.1	
sodium	143	137	135	
chloride	108		107	

Table	3
-------	---

- (a) Complete Table 3 to show the estimated concentration of chloride at time = 0.5 h. [1]
- (b) Calculate the average hourly rate at which urea is removed from the blood of the kidney dialysis patient.

Show your working.

(c) Explain the results when t = 6 h for potassium.

[1]

[2]

Total marks

(d) The table did not show the concentration of proteins in blood. Predict how the trend of proteins would look like between t = 0 h to t = 6 h. Give a reason for your answer

(e) During each treatment, a patient has to undergo dialysis for a few hours. Suggest one way the time can be shortened.

[1] [Total: 7]

4 Fig. 4.1 shows the tissues of a mother and her fetus in a human placenta. The maternal blood and fetal blood remain separate.

(a) State a reason why there must be no mixing of fetal and maternal blood.

[1]

[2]

[2]

[Total: 6]

Total marks

- **5** Scientists are able to treat people with some types of brain damage. They may do this by injecting a patient with cells taken from another person (donor). These cells then migrate to the brain where they divide and specialise to become groups of fully functioning brain cells.
 - (a) State the type of cell division that takes place when the injected cells reach the patient's brain.

[1]

(b) State the term used to describe a group of cells that are specialised to perform a specific function.

[1]

(c) Female patients were injected with cells from male donors. After a period of time, the scientists examined brain cells from these patients and looked for groups of brain cells containing the Y chromosome.

Explain why finding groups of brain cells containing the Y chromosome would suggest to the scientists that the treatment may have been successful.

[3] [Total: 5]

- 6 In the inheritance of the colour of cat fur, the allele for yellow fur (A) is dominant to the allele for grey fur (a).
 - (a) Two heterozygous yellow-coloured cats produced offspring. Use a fully labelled genetic diagram to show how the colour of cat fur is inherited by the offspring.

State the expected ratios of genotypes and phenotypes in the offspring.

[5]

A particular combination of these alleles is known as a 'lethal' combination. Young that inherit this combination die in the uterus during the very early stages of development. This results in a 2:1 ratio of fur colour in the surviving offspring.

(b) Identify the lethal combination of alleles and explain how you reached this answer.

556

lethal combination		
explanation		
•		
		[3]
		[Total: 8]
	Total marks	
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7 Fig. 7.1 shows some of the interactions that take place in an aquatic ecosystem.

- (a) Use the information in Fig. 7.1 to state the trophic level of aquatic plant
 trophic level of fish
- (b) Explain one way, other than for food, that the fish may depend on the aquatic plant.
- (c) Y represents the nitrification process responsible for the conversion of nitrogenous compounds into nitrate ions.

State the name of process X and suggest the type of microorganism which carries out both processes X and Y.

process X	
type of microorganism	[1]

Total marks

Section B

Answer all **three** questions, the last question is in the form **EITHER** / **OR**. Write your answers in the spaces provided.

8 Table 8.1 shows the results obtained in an investigation to compare the rate of transpiration with the rate of water absorption of a plant taken at four hour intervals on a summer day.

time / h rate of water absorption / g/h		rate of transpiration / g/h	light intensity / %	
04 00	1.5	0.25	0	
08 00	1.5	2.0	70	
12 00	3.5	5.0	100	
16 00	5.5	7.25	100	
20 00	3.25	2.5	10	
24 00	2.0	0.75	0	

Table 8.1

(a) Using the data in Table 8.1, plot a graph to show how the rate of water absorption and the rate of transpiration changes with time. Join the points using straight lines.

[4]

Total marks

(b) Based on the results, what is the time of the maximum water absorption and maximum transpiration? Explain your answer.

(c) With reference to Table 8.1, suggest whether the plant can live indefinitely under the conditions of the experiment.

9 Fig. 9.1 shows the stages in the process of genetic engineering to produce the hormone insulin.

(a) (i) Describe how the location and organization of genetic material in the human cell shown in stage **K** of Fig. 9.1 is different from that in the bacterium shown.

	(ii)	Describe how the events in stage \mathbf{K} led to the production of \mathbf{J} .
		[3]
	(iii)	Stage N of Fig. 9.1 takes place in a container similar to that used in the large-scale production of antibiotics.
		State the name of this type of container.
		[1]
(b)	Gene	tic engineering can also be used to produce crop plants for humans to eat.
	Discu plants	iss the potential advantages and dangers of using genetic engineering to produce crop s for humans to eat.
	advai	ntages
		5
		[2]
	dang	ers
		[2]
		[Total: 10]

EITHER

10 (a) A parasitic insect known as red scale affects mainly citrus trees. Fig. 10.1 shows the distribution of red scales and their predators before treatment with an insecticide, shortly after treatment and long after treatment.

With reference to Fig. 10.1, explain why the use of insecticides is not the best way of destroying the red scales.

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(b) Fig. 10.2 shows a sewage treatment plant.

Fig. 10.2

With reference to Fig. 10.2, describe the role of microorganisms in the treatment of sewage.

[5]

[Total: 10]

10 Some muscles in our body work as antagonistic pairs to create movement. In these pairs of muscles, when one muscle contracts, the other muscle relaxes. With reference to named muscles, describe how antagonistic pairs of muscles bring about the following actions.

18

(a)	moving a polus in the deso	phagus alter ir	Igestion of to	oa	
					[4]
(h)	limiting the encount of light	antaring the ex	vo in o bright	, lit op viroppont	
(D)	limiting the amount of light	entering the ey	ye in a brighti	y lit environment	
					[2]
(c)	breathing in air from the at	mosphere into	our lunas		
(0)			our lange		
					[4]
					[10(a). 10]
		End of F	'aper		
	Γ	Total marks]	

(a) moving a bolus in the oesophagus after ingestion of food