

Cambridge International Examinations

Cambridge International General Certificate of Secondary Education

CANDIDATE NAME			
CENTER NUMBER		CANDIDATE NUMBER	
BIOLOGY (US)			0438/41
Paper 4 Theory	(Extended)	Octo	ober/November 2017
			1 hour 15 minutes
Candidates ans	wer on the Question Paper.		

READ THESE INSTRUCTIONS FIRST

No Additional Materials are required.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

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

DO NOT WRITE IN ANY BARCODES.

Answer all questions.

Electronic calculators may be used.

You may lose marks if you do not show your working or if you do not use appropriate units.

Write your Center number, candidate number and name on all the work you hand in.

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.



International Examinations

- 1 Fig. 1.1 and Fig. 1.2 show two images of villi.
 - Fig. 1.1 shows a surface view of many villi viewed through a scanning electron microscope.
 - Fig. 1.2 shows a section of one villus viewed through a light microscope.

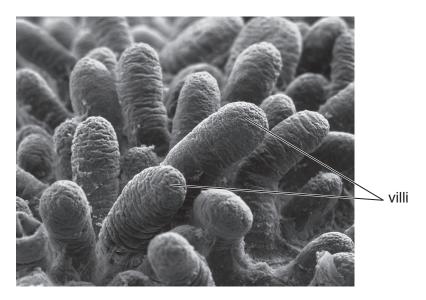


Fig. 1.1

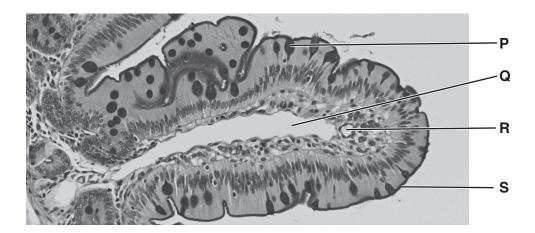


Fig. 1.2

Villi are found in the small intestine. (a) State the function of villi. **(b)** Identify and describe **two** of the labeled components of a villus. Use the letters in Fig. 1.2 in your answer. (c) Some infections in the small intestine can cause diarrhea. Describe the effects of diarrhea on the body. (ii) State the treatment for the effects of severe diarrhea.[1] (d) (i) Blood transports nutrients. State the component of the blood that transports nutrients.

(II)	The nutrients in the blood can be used to become part of cells.
	State the name of this process.
	[1]
(iii)	Amino acids are an example of a type of nutrient transported in the blood.
	State two examples of larger molecules found in cells that are made from amino acids.
	1
	2
	[2]

[Total: 12]

_	roup of students planned an investigation to determine the effects of physical activity on athing rate.
(a)	Describe how the students could measure their breathing rates.
	[2]
(b)	The students measured their breathing rates before physical activity and every minute for five minutes after cycling around the school field.
	Write a hypothesis for their investigation.
	[2]

(c) Fig. 2.1 shows a woman on a stationary bicycle. The mask fitted over her nose and mouth measures the composition of the air she breathes out.

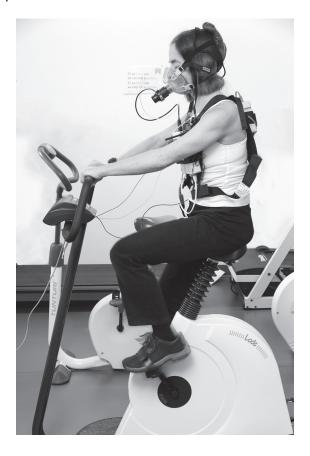


Fig. 2.1

Fig. 2.2 shows the concentration of carbon dioxide in the air expired by the woman in the five minutes after she stopped exercising.

The dashed line on the graph shows the concentration of carbon dioxide in her expired air when she was at rest, before she began to exercise.

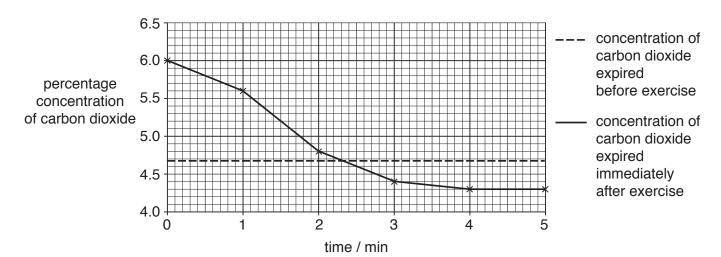


Fig. 2.2

Use the data in Fig. 2.2 in your answer.		cribe and explain the results of the investigation shown in Fig. 2.2.
Before starting the investigation, the researchers confirmed that the woman did not have coronary heart disease. (i) Suggest why. (ii) Explain why exercise is recommended for people with a high risk of developing coronary	Use	the data in Fig. 2.2 in your answer.
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		[
	(ii)	

rne	nowers of pea plants can be pollinated by bees.
(a)	State three features of flowers that would attract insects such as bees.
	1
	2
	3
	[3]
(b)	Successful pollination results in fertilization.
	Describe the events that occur after pollen grains leave the anther of a flower until fertilization takes place.
	[5]

(c) Following fertilization, seeds will form.

In p	pea plants there are two alle	les for height:		
	tall (T)dwarf (t)			
(i)	Define the term allele.			
			•••••	
(::)	A f			[1]
(ii)	dominant or heterozygous	tify the genotype of tall pe	ea piani	ts as eitner nomozygous
	He used a homozygous repea plants.	ecessive dwarf pea plant to	determir	ne the genotype of the tal
	State the name of this type	e of genetic cross.		
				[1]
(iii)	Complete the genetic diagonal offspring from the cross are	gram to determine the genc e tall plants.	otype of	the parent plant if all the
	parental phenotypes	tall	×	dwarf
	parental genotypes		×	
	gametes		+	
	offspring genotype			
	опарніну рненоцуре			[4]

(iv)	Another farmer wants to produce pure-breeding dwarf pea plants.	
	State the genotypes of both of the parent pea plants the farmer should use.	
	Give a reason for your choice.	
	genotypes	
	reason	
		[2]

[Total: 16]

A neuro	n is a type of specialized animal cell.	
(a) (i)	Neurons develop from unspecialized cells.	
	State the name of these unspecialized cells.	
		[1]
(ii)	All animal cells have some common features.	
	State two structural features common to all animal cells.	
	1	
	2	
/iii\	Most nourons are larger than other types of spimal call	[2]
(iii)	Most neurons are longer than other types of animal cell.	
	Suggest why most neurons are very long.	
(1)		[1]
. ,	me neurons connect to effector organs.	
(i)	State the name of the type of neuron that connects to an effector organ.	
		[1]
(ii)	State one example of an effector organ.	
		[1]

(c) Fig. 4.1 shows parts of two neurons. The area in the dashed circle has been magnified.

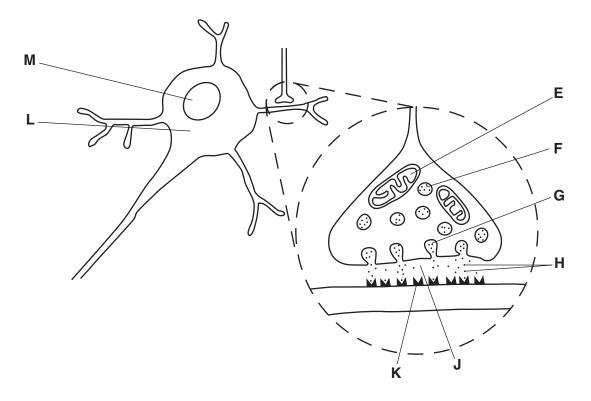


Fig. 4.1

(i) Complete Table 4.1. One row has been done for you.

Table 4.1

letter from Fig. 4.1	name	description
		component of the cell that releases energy during aerobic respiration
Н	neurotransmitters	chemicals that transmit signals from one neuron to the next neuron
		the gap between two neurons
		the sac in which neurotransmitters are transported to the cell membrane
		the molecules that the neurotransmitters bind to
		the structure that controls the activities in the cell

[5]

(ii) State where in the body the neurons in Fig. 4.1 would be found.

.....[1]

(d)	Describe how neurotransmitters move across the gap between two neurons.	
		[3]
(e)	Nerves and hormones coordinate the functions of the body.	
	Suggest why blinking of the eyes is coordinated by nerves and not hormones.	
		[1]
		[Total: 16]

Ethanol It can be	used as a biofuel.	obically, ethanol able resource th		I from a wide range
Ethanol It can be Table 5.	s a type of sustain used as a biofuel.	able resource th	at can be produced	_
It can be	used as a biofuel.		·	_
It can be	used as a biofuel.		·	_
	summarizes some	e information abo	out crops that are us	
cro				sed to make biofuel.
cro		Table 5	5.1	
	biofuel produced	energy yield /GJ per ha	optimum growth temperature/°C	optimum annual rainfall range/mm
wheat	ethanol	53–84	24	800–1200
corn	ethanol	63–76	18	360–1000
sugar be	t ethanol	110–122	18	360–1000
sugar ca	e ethanol	110–140	28	800–1200
oil palm	oil	150–166	28	1100–2500
Suç biot	all of 1000 mm. gest and explain w lel in Uruguay. the information in ²	·		le crop to grow for p

(ii)	Sugar cane requires soil with high concentrations of nitrogen and potassium.
	Describe how the lack of nitrate ions would affect the production of sugar cane.
	[3]
(iii)	Researchers in Brazil are considering using microscopic algae that live in water to produce biofuels. They have found that algae can produce a maximum amount of energy of 200 GJ per $\rm m^2$.
	$1 \text{m}^2 = 0.0001 \text{ha}$
	Convert the production of biofuel from algae into GJ per ha.
	Space for working.
	GJ per ha [1]
(iv)	Suggest why people who are concerned about the environment want countries to produce more biofuel from algae rather than the crops listed in Table 5.1.
	[3]

(c)	Define the term sustainable development.
	101
	[2]
	[Total: 14]

Viruses can cause diseases.				
(a)	(i)	State two other features of all viruses.		
		1		
		2		
	(ii)	Describe how vaccination can prevent the spread of disease.		
		[5]		

(b) Fig. 6.1 shows four different viruses.

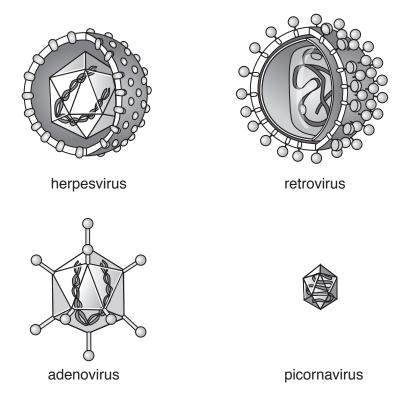


Fig. 6.1

Suggest one feature that could be used to classify viruses into groups.	
	[1]
	[Total: 8]

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