

Cambridge Assessment International Education

Cambridge Pre-U Certificate

CANDIDATE NAME					
CENTRE NUMBER			CANDIDATE NUMBER		

BIOLOGY (PRINCIPAL)

9790/02

Paper 2 Data Analysis and Planning

May/June 2019

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

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

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.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the Question Paper.

Section B

Answer the question.

Write your answer in the space provided on the Question Paper.

Electronic calculators may be used.

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

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.

For Examiner's Use			
Section A			
Section B			
Total			

This syllabus is regulated for use in England, Wales and Northern Ireland as a Cambridge International Level 3 Pre-U Certificate.

This document consists of 14 printed pages and 2 blank pages.



Answer all questions.

Section A – Data Analysis

Alanine transaminase (ALT) is an enzyme found in the cytoplasm of hepatocytes (liver cells).
ALT catalyses the transamination reaction shown in Fig. 1.1.

Fig. 1.1

(a)	Use Fig. 1.1 to explain what is meant by a transamination reaction.
	[2]
(b)	A digital biosensor to measure the concentration of glutamate works on the same principle as a glucose biosensor.
	Outline how a glucose biosensor works.
	INI

Doctors can measure the concentration of ALT in a person's blood. This is done to obtain a measure of damage to the liver.

(c)	Suggest why blood ALT concentration provides a measure of damage to the liver.				
	[2]				

Another transaminase enzyme, aspartate transaminase (AST), is found in the mitochondria of a variety of cells, including hepatocytes.

Table 1.1 shows the distribution of ALT and AST in the body, as well as the time taken for the quantity of each enzyme in the blood to halve.

Table 1.1

enzyme	location where found	percentage distribution in cell		percentage distribution in cell enzyme in to halve		time taken for quantity of enzyme in blood to halve /hours
ALT liver		cytoplasm	100	47		
		mitochondria	0	77		
AST	heart, liver, skeletal muscle,	cytoplasm	20	17		
AOT	pancreas and kidney	mitochondria	80	17		

(d)	The concentration of AST in the blood is not, by itself, a reliable indicator of liver damage.
	Use Table 1.1 to explain why blood AST concentration by itself is not a reliable indicator or liver damage.
	[2]

In clinical practice, diagnosis of liver damage is based on:

- the concentration of ALT in the blood
- the blood AST:ALT ratio.
- **(e)** Blood ALT concentration and the AST:ALT ratio provide an indication of the condition of a person's liver.

Table 1.2 shows the liver conditions associated with different blood ALT concentrations and AST:ALT ratios.

Table 1.2

liver condition	blood ALT concentration /arbitrary units	AST:ALT
normal	1 to 40	0.8:1
acute (short-term) viral liver damage	100 to 1100	<0.8:1
acute non-alcoholic liver damage	30 to 100	<0.8:1
chronic (long-term) alcoholic liver damage	30 to 300	>2:1

The blood concentrations of AST and ALT were measured in six people who had recently been admitted to hospital.

Table 1.3 shows the data collected.

(f)

Table 1.3

person	blood AST concentration /arbitrary units	blood ALT concentration /arbitrary units	AST:ALT
Α	37	62	0.6:1
В	27	38	0.7:1
С	26	33	0.8:1
D	620	1034	0.6:1
E	140	54	2.6:1
F		20	0.8:1

(i)	Calculate the blood AST concentration for person F . Write your answer in Table 1.3. [1
(ii)	Use Table 1.2 to identify the people in Table 1.3 who could be diagnosed with the following conditions.
	acute non-alcoholic liver damage
	chronic alcoholic liver damage
	[2
Alco	phol causes damage to mitochondria.
Exp	lain why alcohol damage to the liver can cause an increase in concentration of AST in the od.

......[2]

[Total: 15]

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2 Fig. 2.1 shows three regions found in the alimentary canal (gut) of all mammals.

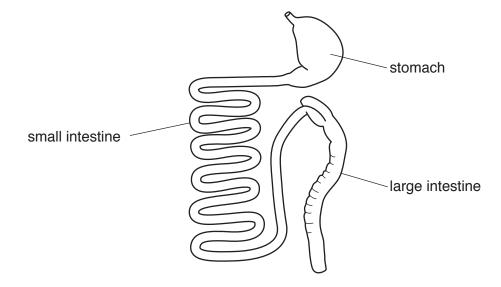


Fig. 2.1

(a)	Outline the roles of the stomach, small intestine and large intestine of a mammal.	
	stomach	
	small intestine	
	large intestine	

The guts of three mammals were measured. The data are shown in Table 2.1.

Table 2.1

	type of	body	length of gut section/m			volume of gut section/dm ³		
mammal	type of consumer	length /m	stomach	small intestine	large intestine	stomach	small intestine	large intestine
horse	herbivore	2.3	_	22.6	6.7	10.0	60.0	125.0
wild boar	omnivore	1.8	_	18.3	6.6	8.0	9.2	10.2
dog	carnivore	0.8	_	4.1	0.7	4.3	1.6	1.0

Table 2.2 shows the total intestine length and ratio of total intestine length to body length for the three mammals.

Table 2.2

mammal	total intestine length /m	total intestine length : body length
horse	29.3	13:1
wild boar	24.9	14:1
dog	4.8	6:1

(b)	Compare and explain the ratios of total intestine length to body length for the three mammals shown in Table 2.2.
	[4]

Comment on the difference in volumes of the parts of the gut for the horse and the dog shown in Table 2.1.
[5
large intestines of some mammals contain a diverse community of bacteria and ciliates toctista).
Suggest two ways in which ciliates are adapted to survive in the large intestine.
[2
nvestigation was carried out to measure how the concentration of a dietary supplement affects diversity of the microorganisms in the human large intestine.
Traditional methods for identifying microorganisms include examining cells under the microscope and their colonies when cultured on agar. Modern methods have allowed species to be identified with greater precision.
State one modern method that could be used to identify different species of microorganism.
[1
i e

(f)	such as Simpson's, to			calculate an index of diversity
				[2]
The	results of the investig	ation are shown in T	able 2.3.	
			le 2.3	
			10 2.0	7
		percentage supplement concentration	Simpson's index of diversity	
		0	0.943	-
		8	0.959	
		16	0.963	-
		24	0.967	
		32	0.961	
(g)	The manufacturer or increase the number Use the data in Table	of beneficial species	s in the gut.	taking the supplement would
				[3]

[Total: 20]

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Section B - Planning

Teixobactin is an antibiotic that prevents the formation of peptidoglycan. It has been shown to be effective against the Gram-positive bacterium *Bacillus subtilis*.

Plan an investigation to compare the effect of a range of concentrations of teixobactin on growth of *B. subtilis*.

You are provided with the following materials. Choose your materials from this list. You may **not** use any additional materials.

- stock teixobactin solution
- culture broth of B. subtilis
- 70% alcohol
- distilled water
- inoculating loops
- glass spreaders
- culture bottles with lids
- Petri dishes with lids
- molten sterile nutrient agar (ready to pour)
- antibacterial cleaner
- paper towels
- Bunsen burner
- matches
- water-resistant marker
- beakers and flasks of different sizes
- clock or electronic timer
- ruler, with mm scale
- thermometer
- incubator
- refrigerator
- pipettes and pipette fillers
- teat pipettes
- syringes of different sizes
- glass rods for stirring
- test-tubes with bungs
- test-tube racks
- aluminium foil
- autoclave
- large beaker containing disinfectant solution
- filter paper discs, 5 mm in diameter
- forceps
- adhesive tape
- black 2 mm grid on transparent plastic sheet

Your plan should:

- include a clear statement of the hypothesis or prediction
- identify the key variables
- give full details and explanations of the procedures that you would adopt to ensure that the results are as precise and repeatable as possible
- show how you would present and analyse your results
- include a brief risk assessment
- be written in clear, scientific language.

[25]

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