



CANDIDATE  
NAME

CENTRE  
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**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	
<b>Section A</b>	
<b>Section B</b>	
<b>Total</b>	

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.



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.

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..... [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		time taken for quantity of enzyme in blood to halve /hours
ALT	liver	cytoplasm	100	47
		mitochondria	0	
AST	heart, liver, skeletal muscle, pancreas and kidney	cytoplasm	20	17
		mitochondria	80	

(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 of liver damage.

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..... [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**

<b>liver condition</b>	<b>blood ALT concentration /arbitrary units</b>	<b>AST:ALT</b>
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.

**Table 1.3**

person	blood AST concentration /arbitrary units	blood ALT concentration /arbitrary units	AST:ALT
A	37	62	0.6:1
B	27	38	0.7:1
C	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

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chronic alcoholic liver damage

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[2]

- (f) Alcohol causes damage to mitochondria.

Explain why alcohol damage to the liver can cause an increase in concentration of AST in the blood.

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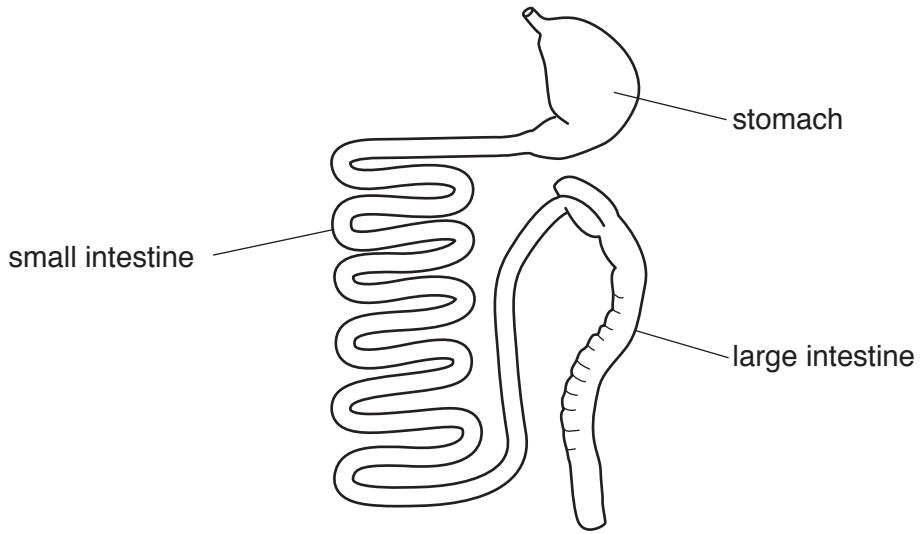
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..... [2]

[Total: 15]



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

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small intestine

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large intestine

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[3]





- (c) Comment on the difference in volumes of the parts of the gut for the horse and the dog shown in Table 2.1.

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The large intestines of some mammals contain a diverse community of bacteria and ciliates (protocista).

- (d) Suggest **two** ways in which ciliates are adapted to survive in the large intestine.

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..... [2]

An investigation was carried out to measure how the concentration of a dietary supplement affects the diversity of the microorganisms in the human large intestine.

- (e) 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.

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..... [1]

- (f) Describe the data that would need to be collected in order to calculate an index of diversity, such as Simpson’s, to compare microorganism diversity.

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..... [2]

The results of the investigation are shown in Table 2.3.

**Table 2.3**

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 of the dietary supplement claimed that taking the supplement would increase the number of beneficial species in the gut.

Use the data in Table 2.3 to evaluate this claim.

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..... [3]

[Total: 20]



**Section B – Planning**

- 3 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.

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A series of 30 horizontal dotted lines for writing.

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