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9790/02

May/June 2016

1 hour 15 minutes

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

DO **NOT** WRITE IN ANY BARCODES.

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

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

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

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	

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

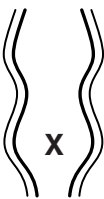
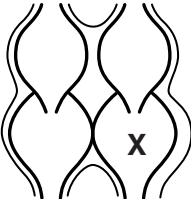
This document consists of **14** printed pages and **2** blank pages.

Answer **all** the questions.

Section A – Data Analysis

- 1 Physiological data collected from a range of animals, when at rest, is shown in Table 1.1.

Table 1.1

	desert locust (<i>Schistocerca gregaria</i>)	lagoon triggerfish (<i>Rhinecanthus aculeatus</i>)	cane toad (<i>Rhinella marina</i>)	brown rat (<i>Rattus norvegicus</i>)
diagram of heart (not to scale)				
body mass / kg	0.002	0.370	0.360	0.400
maximum blood pressure at X / kPa	0.01	3	5	14
heart rate / beats per minute (bpm)	130	57	30	280
cardiac output per unit body mass / cm ³ min ⁻¹ kg ⁻¹	123	30	57	156
stroke volume per unit body mass / cm ³ kg ⁻¹	0.95	0.53		0.56
partial pressure of oxygen at X / kPa	2	3	7	14

- (a) Stroke volume is the volume of blood leaving the heart with each beat.

It can be found by using the equation:

$$\text{cardiac output} = \text{heart rate} \times \text{stroke volume}$$

- (i) Complete Table 1.1 by calculating the stroke volume per unit body mass of the cane toad. [1]
- (ii) In Table 1.1, the stroke volume and cardiac output figures have been divided by the mass of the animal to give a figure per unit body mass.

Explain the reason for manipulating the figures in this way.

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.....[1]

- (b) Explain how the circulatory system of the rat achieves a much greater maximum blood pressure than that of the other animals in Table 1.1.

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- (c) Comment on the values for the partial pressure of oxygen at **X** in Table 1.1.

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- (d) Table 1.2 shows physiological data for an Antarctic fish, the bald notothen, *Pagothenia borchgrevinki*.

Table 1.2

	at rest	active
body mass /g	198	198
maximum blood pressure /kPa	3	5
heart rate /bpm	11	45
cardiac output per unit body mass /cm ³ min ⁻¹ kg ⁻¹	30	51

- (i) The lagoon triggerfish, included in Table 1.1, lives in warm, tropical waters.

Suggest why the resting heart rate of the bald notothen is lower than that of the lagoon triggerfish.

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- (ii) Calculate the percentage increase in cardiac output of the bald notothen when active compared to when it is at rest.

Show your working.

percentage increase[2]

- (iii) Explain the increase in the cardiac output of the bald notothen when active.

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[Total: 16]

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(a) Describe and explain the data shown in Fig. 2.1.

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- (b) In a separate study, the number of species of reptile was recorded on each of six other tropical islands. The extinction rate on each of these islands was calculated using historical data.

These data are shown in Table 2.1.

Table 2.1

island	number of species of reptile	extinction rate /arbitrary units
P	18	2.1
Q	21	1.9
R	41	1.7
S	53	1.4
T	74	1.4
U	89	1.0

- (i) Plot the data shown in Table 2.1, on the grid provided opposite, to show the relationship between the number of species of reptile and the extinction rate. [2]
- (ii) Use Fig. 2.1 and the graph drawn in (i) to estimate the extinction rate on an island with an area of 50 km².

Indicate how you have worked out your answer.

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- (iii) Describe the pattern shown by the graph drawn in (i) and suggest how the information in Fig. 2.1 provides a possible explanation for this.

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extinction rate
/arbitrary units

0
0

number of species of reptile

- (c) The species of reptile present on islands are often different to those found on the nearest mainland.

Suggest reasons for these differences.

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- (d) Discuss the difficulties in assessing the number of species and extinction rates on islands.

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[Total: 19]

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Section B – Planning

- 3 Biological control is an established method for reducing pest numbers on farms. One example of biological control is the introduction of a species of parasitic wasp, *Catolaccus grandis*, in an attempt to reduce the damage to cotton crops caused by the boll weevil, *Anthonomus grandis* (weevils are a type of beetle). In a recent trial, large numbers of the wasp were released onto a farm in Mexico.

Conservationists were concerned that the release may have had an impact on populations of different weevil species in adjacent grassland. These weevils form part of the local ecosystem and feed on the leaves of naturally occurring grass species.

It was decided that the weevil populations should be studied in order to determine any changes over time.

Plan an investigation to determine the effects of releasing the parasitic wasp, *C. grandis*, on the local populations of grassland weevils.

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

- supply of parasitic wasps, *C. grandis*
- metre ruler
- 50m tape measure
- non-toxic biodegradable paint
- paint brushes
- quadrats of different sizes
- pooter
- collecting pots
- sweep net
- butterfly net
- pitfall traps
- beating tray
- calculator
- pH testing kit
- light meter
- soil temperature probe
- thermometer
- trowel
- bucket
- clipboard, paper and pencil
- random number table
- identification keys
- 24-hour timer
- marker pegs
- compass
- 100m length of string

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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