Write your name here

Surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Biology

Advanced

Unit 6B: Practical Biology and Investigative Skills

Tuesday 14 January 2014 – Morning
Time: 1 hour 30 minutes

Paper Reference
WBI06/01

You must have:
Ruler, Calculator, HB Pencil

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Write your answers in the spaces provided in this question paper *– there may be more space than you need.*

Information

- The total mark for this paper is 50.
- The marks for **each** question are shown in brackets *– use this as a guide as to how much time to spend on each question.*
- You will be assessed on your ability to organise and present information, ideas, descriptions and arguments clearly and logically, including your use of grammar, punctuation and spelling.
- Any blank pages are indicated.

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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PEARSON

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Answer ALL questions.

1 Lemurs are primates found on the island of Madagascar. At least 33 different species of lemur are living on the island today. Scientists would like to know how closely related the different species of lemur are.

In one study, the scientists collected tissue samples from several individuals of each species. For each sample, they examined the DNA sequences of five different genes.

The polymerase chain reaction (PCR) was used to amplify the DNA in the samples.

(a) Describe how to amplify a strand of DNA using the polymerase chain reaction (PCR).

(5)

(b) An enzyme is used in the amplification process. Describe **two** properties of this enzyme that are relevant to its biological activity in this process.

(2)

(c) Temperature is an important variable in the PCR.

Choose **one** step in the process you described in part (a) and explain why changing the reaction temperature might reduce the production of DNA in this reaction.

(2)

Step .....

Explanation .....

(d) Suggest an explanation for each of the following statements.

(i) The scientists collected and analysed samples from more than one individual of each species.

(2)

(ii) For each sample, the scientists examined the DNA sequence of **five** different genes.

(2)

(Total for Question 1 = 13 marks)

2 A student decided to investigate whether drinking coffee containing caffeine had an effect on reaction times.

She selected 27 students who regularly had drinks containing caffeine.

The students did not have any drinks containing caffeine for 24 hours before the investigation. On the morning of the investigation, the students drank either one cup of coffee containing caffeine or one cup of coffee with no caffeine.

The students then went to their first lesson. Immediately after the lesson, the reaction times of the students were measured in milliseconds (ms).

The raw results are shown below.

Group given coffee containing caffeine

355 ms, 310 ms, 270 ms, 450 ms, 350 ms, 316 ms, 298 ms, 368 ms, 394 ms, 347 ms, 246 ms, 340 ms, 415 ms, 274 ms, 300 ms

Group given coffee with no caffeine

426 ms, 440 ms, 510 ms, 412 ms, 398 ms, 450 ms, 340 ms, 484 ms, 365 ms, 410 ms, 380 ms, 264 ms

(a) Write a suitable null hypothesis for this investigation.

(2)

.....

.....

.....

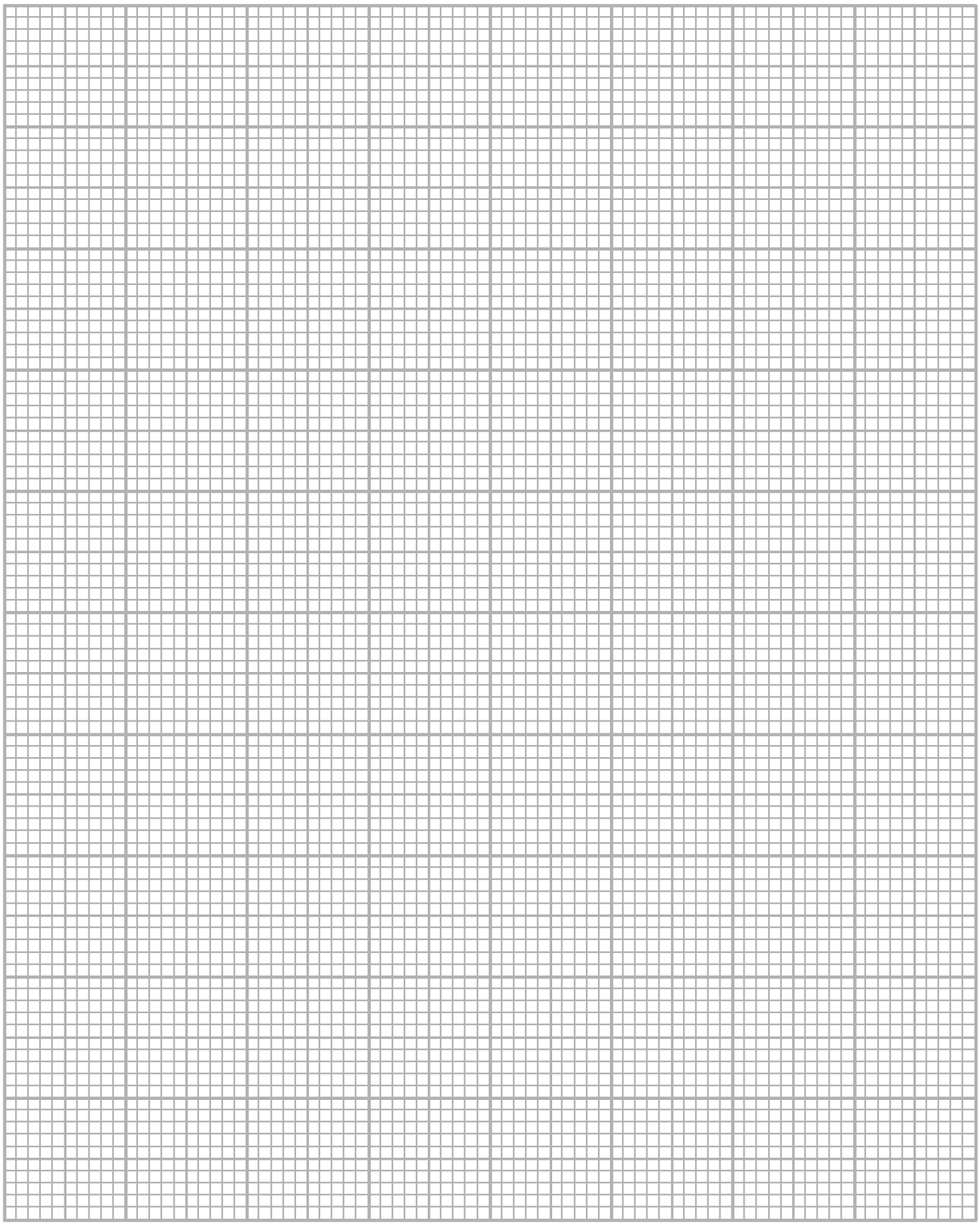
(b) Calculate the **mean value** for each group.

Prepare a suitable table to display the mean value and the **sample size** for each group.

(3)

(c) On the graph paper below, draw a suitable graph to show the effect of caffeine on mean reaction times and the variability of the data.

(3)



(d) The student applied a *t*-test to the data she obtained. She obtained a value of $t = 3.03$ from her calculation.

The table below shows critical values of *t* with different degrees of freedom at different significance levels.

The number of degrees of freedom is calculated using the formula shown below.

Degrees of freedom = $(n_1 - 1) + (n_2 - 1)$

where n_1 and n_2 represent the size of the groups being compared.

Number of degrees of freedom	Significance level	
	p = 0.05	p = 0.01
10	2.23	3.17
11	2.20	3.11
12	2.18	3.06
13	2.16	3.01
14	2.15	2.98
15	2.13	2.95
16	2.12	2.92
17	2.11	2.90

Number of degrees of freedom	Significance level	
	p = 0.05	p = 0.01
18	2.10	2.88
19	2.09	2.86
20	2.09	2.85
25	2.06	2.79
30	2.04	2.75
60	2.00	2.66
100	1.98	2.63
∞	1.96	2.58

What conclusions can be drawn from this investigation?

Use the information provided in the table above and in the graph you have drawn to **explain** your answer.

(3)

(e) Suggest why it is difficult to draw a valid conclusion from the results of this investigation.

(3)

(Total for Question 2 = 14 marks)

3 Amphibians produce skin secretions that have antibiotic properties. In one study, scientists found antibiotic properties in secretions taken from different species of poisonous *Mantella* frogs. The photograph below shows an example of a *Mantella* frog.

Magnification ×2

Plan an investigation to compare the antibiotic properties of the secretions from two different species of *Mantella* frog.

Your answer should give details under the following headings.

(a) A consideration of whether there are any safety or ethical issues that you would need to take into account.

(3)

(b) A description of preliminary practical work that you might undertake to ensure your proposed method would provide meaningful data.

(3)

(c) A detailed method, including an explanation of how important variables are to be controlled or monitored.

(10)

[2 marks are available in this section for the quality of written communication.]

(d) A clear explanation of how your data are to be recorded, presented and analysed in order to draw conclusions from your investigation.

(4)

(e) The limitations of your proposed method.

(3)

(Total for Question 3 = 23 marks)

TOTAL FOR PAPER = 50 MARKS

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