Write your name here

Surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Biology

Advanced

Unit 6: Practical Biology and Investigative Skills

Tuesday 26 January 2016 – Afternoon
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.
- Answer the questions in the spaces provided
  – *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.

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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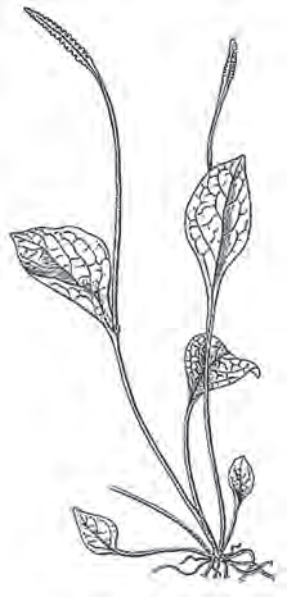
PEARSON

Answer ALL questions.

1 The diagram below shows a fern from the family Ophioglossaceae, commonly known as adder's-tongue ferns.



There are many species in this family. Some of the species have different diploid numbers of chromosomes. The diploid numbers range from 240 to 1250 chromosomes.

A student investigated the relationship between diploid number and the proportion of time spent by cells in different phases of the cell cycle.

She prepared root tip squashes from Ophioglossaceae species with different numbers of chromosomes. She then determined the stage of mitosis of each cell in a sample from each species.

(a) Describe how the root tip squash could be prepared and used to identify the stage of mitosis of each cell in a sample.

(5)

(b) (i) Suggest **two** variables that should be controlled when the pieces of plant root tissue are selected.

(2)

1 .....

.....

.....

2 .....

.....

.....

(ii) Choose **one** of the variables you identified in part (i). Describe the effect on mitosis if this variable was not controlled.
Give a reason for your answer.

(2)

Variable .....

Effect on mitosis .....

.....

.....

.....

Reason .....

.....

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(c) For each root tip squash, the student recorded the number of cells in each stage of mitosis.

Suggest how she could estimate the proportion of time a cell spends in each stage.

(2)

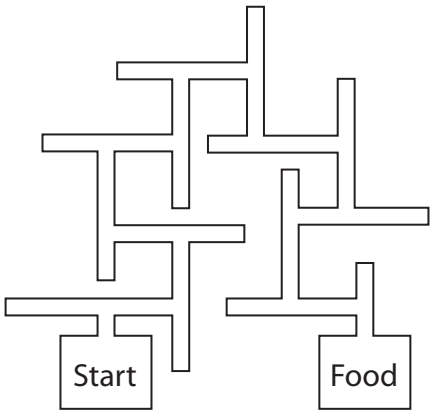
(d) The student found that, as the diploid number increased, the proportion of time cells spent in prophase increased.

Using your knowledge of mitosis, suggest why the proportion of time spent in prophase increased.

(2)

(Total for Question 1 = 13 marks)

2 The diagram below shows a maze.



When a rat is placed in this maze, it explores and searches for food. If the rat is placed in the maze again, it takes less time to find the food. This shows that the rat learns the way through the maze.

A student wondered whether animals with larger brains are better at learning. She investigated five types of small mammal. These mammals and their typical brain mass are listed below:

- Cavy (3.8 g)
- Gerbil (1.4 g)
- Hamster (0.9 g)
- Mouse (0.4 g)
- Rat (2.1 g)

The student used three of each type of mammal. She placed Cavy A in the 'Start' area of the maze and recorded the time taken for it to find the food. She carried out 10 trials for Cavy A. She then repeated the procedure with Cavy B and Cavy C.

The student then repeated this procedure with the other four types of mammal.

Using the times taken for the first and tenth trial, she calculated the percentage decrease in time taken.

Her results are shown below.

Cavy A	18%	Cavy B	12%	Cavy C	7%
Hamster A	29%	Hamster B	37%	Hamster C	23%
Gerbil A	27%	Gerbil B	33%	Gerbil C	42%
Mouse A	46%	Mouse B	51%	Mouse C	35%
Rat A	52%	Rat B	37%	Rat C	61%

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

(2)

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.....

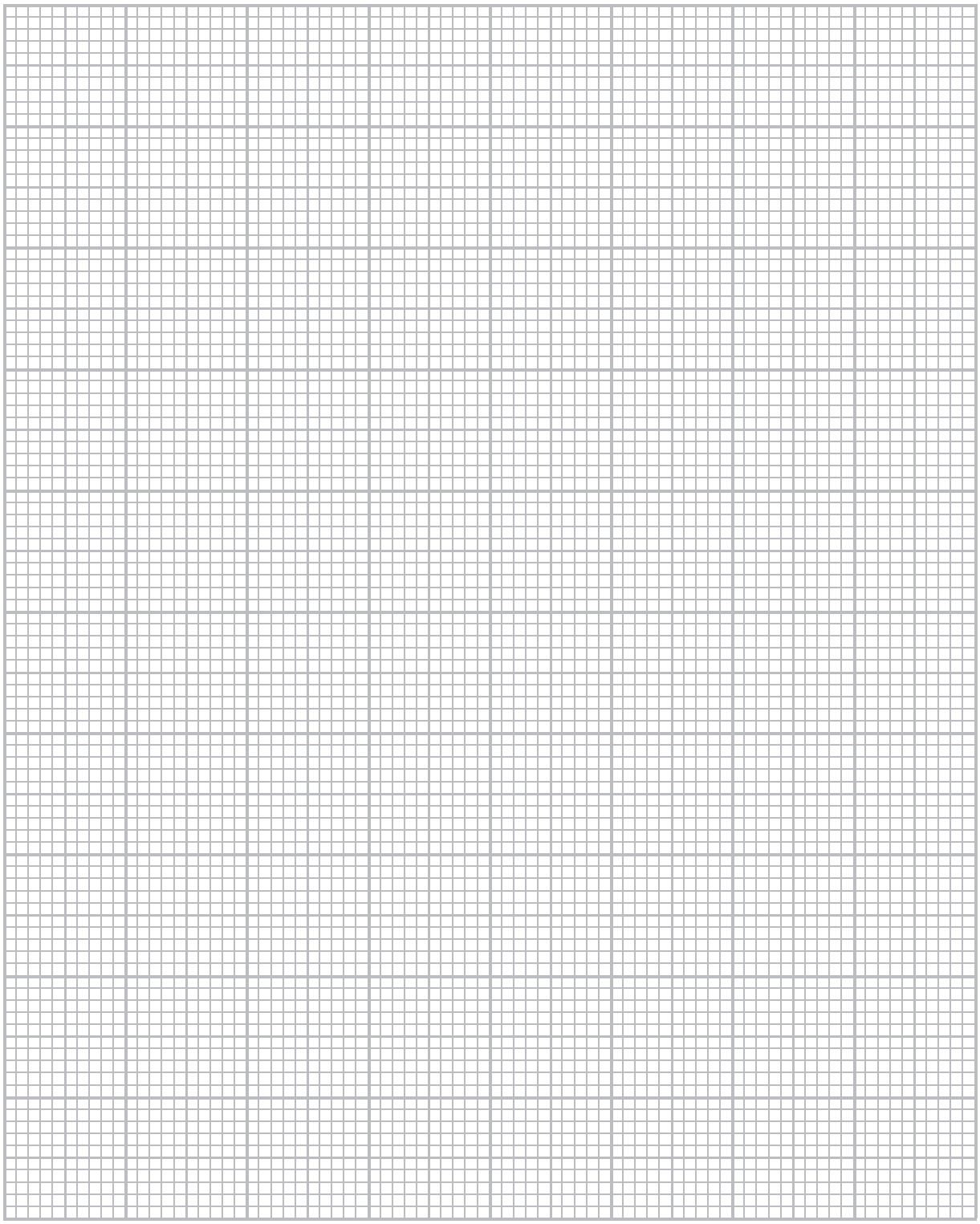
(b) Calculate the mean percentage decrease in time taken for each type of mammal in this investigation.

Draw a suitable table to display the typical brain mass and your calculated mean for each type of mammal.

(3)

(c) On the graph paper below, draw a suitable graph to show the relationship between brain mass and the mean percentage decrease in time taken to find food. Include an indication of the variability of the data.

(3)



(d) The student used a statistical test to assess the strength of the relationship between brain mass and mean percentage decrease in time taken to find food.

She calculated a value of 0.403.

For this statistical test, the number of degrees of freedom is equal to (n – 2), where n is the number of types of mammal tested.

The table below shows some critical values for this statistical test.

Degrees of freedom	Level of significance			
	0.10	**0.05**	**0.01**	**0.005**
1	0.951	0.988	0.9995	0.9999
2	0.800	0.900	0.980	0.990
3	0.687	0.805	0.934	0.959
4	0.608	0.729	0.882	0.917
5	0.551	0.669	0.833	0.875
6	0.507	0.621	0.789	0.834
7	0.472	0.582	0.750	0.798
8	0.443	0.549	0.715	0.765
9	0.419	0.521	0.685	0.735
10	0.398	0.497	0.658	0.708
11	0.380	0.476	0.634	0.684
12	0.365	0.457	0.612	0.661
13	0.351	0.441	0.592	0.641
14	0.338	0.426	0.574	0.623
15	0.327	0.412	0.558	0.606

What conclusion can be drawn from this investigation?
Use your graph and the information in the table to explain your answer.

(4)

(e) Suggest reasons why it may not be possible to draw valid conclusions from the results of this investigation.

(3)

(Total for Question 2 = 15 marks)

3 Some parasites produce perforins. Perforins are proteins that form pores in the membranes of animal and plant cells. These pores make the membranes fully permeable and cause the cells to die.

Scientists have identified five substances (A, B, C, D and E) which might act as inhibitors of perforin. These substances might protect the cells against the effects of perforin.

Plan an investigation to test whether these substances inhibit the effect of perforin.

You are provided with:

- a solution of perforin
- solutions of substances A, B, C, D and E
- plant tissue with cells containing coloured pigments in their vacuoles.

Your answer should give details under the following headings.

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

(2)

(b) Suggestions for 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.

(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 = 22 marks)

TOTAL FOR PAPER = 50 MARKS