

Please check the examination details below before entering your candidate information

Candidate surname					Other names				
Centre Number					Candidate Number				
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**Pearson Edexcel International Advanced Level**

Time 1 hour 20 minutes

Paper reference **WBI16/01**

**Biology**

**International Advanced Level**

**UNIT 6: Practical Skills in Biology II**

**You must have:**  
Scientific calculator, ruler, 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.*
- **Show all your working out** in calculations and **include units** where appropriate.

### 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.*
- Any diagrams may NOT be accurately drawn, unless otherwise indicated.

### Advice

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

Turn over ►

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Q:1/1/1/1/1/



  
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**Answer ALL questions.**

- 1 The photograph shows a zebrafish, *Danio rerio*.  
Zebrafish live in freshwater throughout South Asia.



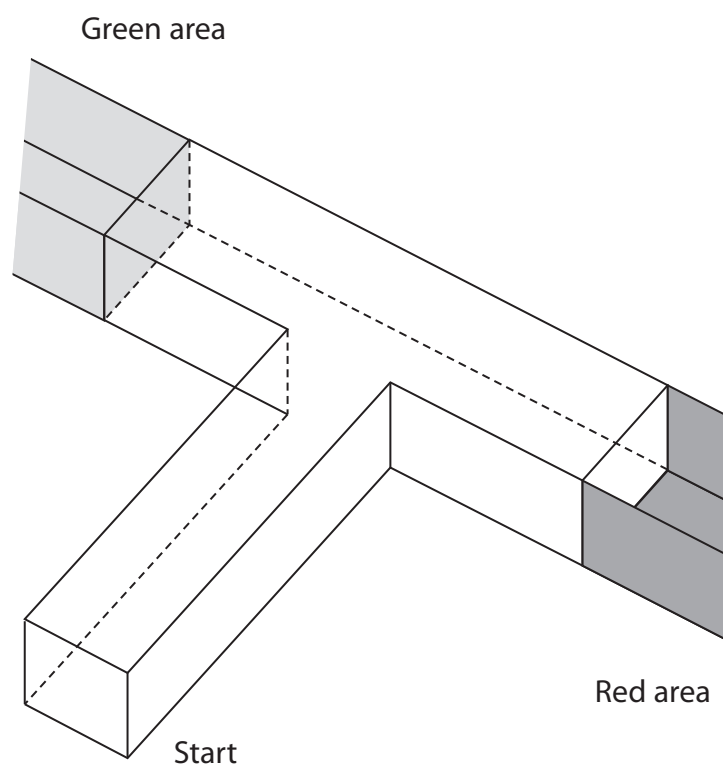
Magnification  $\times 1$

(Source: © Pablo Bou Mira/Alamy Stock Photo)

Zebrafish are social animals. They can be kept in large numbers in tanks in the laboratory.

A scientist investigated the preference of zebrafish for different coloured areas of a T-maze, filled with water.

The diagram shows the T-maze used in this investigation.



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A group of 72 zebrafish was used in this investigation.

These fish were raised from eggs of zebrafish living in a river.

Each fish was placed at the start of the T-maze and the colour area the fish swam to was recorded.

The results are shown in the table.

Number of fish preferring	
Green area	Red area
44	28

- (a) Each fish was returned to the source that the eggs came from.

Suggest **one** reason why the scientist thought it was acceptable to carry out this investigation.

(1)

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- (b) (i) The scientist made a prediction:

There is no difference between the observed (O) and expected (E) colour preference of the zebrafish.

Using the formula calculate the value of Chi squared.

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

(3)

Answer .....

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(ii) The critical value of Chi squared was 3.84.

Give a conclusion that could be made from this investigation.

(1)

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(c) (i) State **one** abiotic variable that could affect the results of this investigation.

(1)

Abiotic variable

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(ii) Describe how this abiotic variable could be controlled and the effect it could have on the results if it is not controlled.

(2)

Variable

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Describe how this variable is controlled

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Describe the effect it could have on the results if it is not controlled.

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(d) Suggest why the scientist used each zebrafish only once.

(1)

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**(Total for Question 1 = 9 marks)**

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3 The photograph shows a sunflower plant, *Helianthus annuus*.



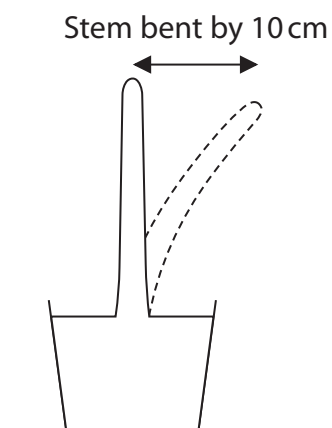
(Source: © Richard Griffin/Alamy Stock Photo)

A student investigated the effect that wind had on the bending of plants.

Thirty sunflower plants were grown in individual pots until they were 60 cm tall.

The leaves and flowers were removed from the sunflower plants.

For one group of 15 plants, the top of each stem was bent by 10 cm and then released as shown in the diagram.



The bending of the stems was repeated once a day for eight weeks.

A control group of 15 plants were kept in the same conditions but without the stems being bent.

The diameter of the stem at the base of each plant was measured after eight weeks.

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The results of this investigation are:

Experimental group stem diameters (mm)

17.34	18.16	17.61	18.14	17.64	18.14	17.95	17.78
17.69	17.84	17.99	17.95	17.89	18.16	18.22	

Control group stem diameters (mm)

17.15	17.52	17.57	17.03	17.26	17.31	17.09	17.38
17.41	17.21	17.34	17.16	17.15	17.32	17.60	

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

(1)

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(b) Draw a suitable table to display the **data** and your calculated **means** for these two groups of plants.

(3)

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(c) Plot a suitable graph to show the mean diameter of the stems for each group of plants. Include an indication of the variability of these data.

(3)



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(d) The student analysed this data with a  $t$  test using the formula:

$$t = \frac{(\bar{x}_A - \bar{x}_B)}{\sqrt{\frac{(S_A)^2}{n_A} + \frac{(S_B)^2}{n_B}}}$$

where:

$\bar{x}$  is the mean value for each group of plants

$n$  is the number of samples for each group of plants

$(S_A)^2 = 0.03$  and  $(S_B)^2 = 0.06$

(i) Calculate the value of  $t$ .

(2)

Answer .....



(ii) The table shows the critical values of  $t$  for different degrees of freedom.

The number of degrees of freedom =  $(n_A - 1) + (n_B - 1)$

Degrees of freedom	Level of significance ( $p$ )	
	0.05	0.01
15	2.13	2.95
16	2.12	2.92
17	2.11	2.90
18	2.10	2.88
19	2.09	2.86
20	2.09	2.84
21	2.08	2.83
22	2.07	2.82
23	2.07	2.81
24	2.06	2.80
25	2.06	2.79
26	2.06	2.78
27	2.05	2.77
28	2.05	2.76
29	2.04	2.76
30	2.04	2.75

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Deduce the conclusions that can be drawn from this investigation.  
Use your graph and the information in the table to support your answer.

(2)

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(e) Explain why it may **not** be reasonable to draw valid conclusions from the results of this investigation.

(2)

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**(Total for Question 3 = 13 marks)**





(b) Devise a detailed method, including an explanation of how you would control and monitor important variables.

(8)

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(c) Describe how your results should be recorded, presented and analysed in order to draw conclusions from your investigation.

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(d) Suggest **two** limitations of your proposed method.

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**(Total for Question 4 = 16 marks)**

**TOTAL FOR PAPER = 50 MARKS**

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