

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use Total Task 2



General Certificate of Education
Advanced Level Examination
June 2011

Biology

BIO6X/PM2

**Unit 6X A2 Externally Marked Practical Assignment
Task Sheet 2**

To be completed before the EMPA Written Test.

For submission by 15 May 2011

For this paper you must have:

- a ruler with millimetre measurements
- a calculator.

Turn alternation in maggots

Introduction

Many animals show behaviour called turn alternation. This means if the animal is forced to turn in one direction it is more likely to turn in the opposite direction next time it has a choice. In this part of the investigation, you will investigate whether maggots show turn alternation.

Task 2

Materials

You are provided with

- the maze you made in Task 1
- maggots
- cotton wool buds
- a plastic teaspoon

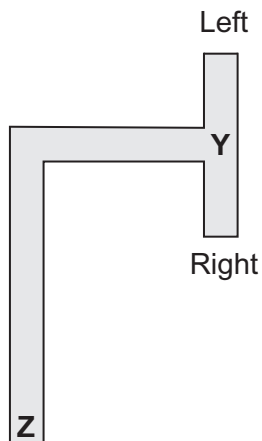
You may ask your teacher for any other apparatus you require.

Method

Read these instructions carefully before you start your investigation.

1. Use the maze you made in Task 1, with barrier **D** removed.

Plan of the maze



2. Place a maggot at point **Z** in the maze.
3. Record whether the maggot turns left or right when it reaches the junction at **Y**.
4. Repeat steps 2 and 3 until you have sufficient data to carry out a statistical test.

You will need to decide for yourself

- how many maggots to use
- how often to use each maggot.

Presenting data

Record your raw data in an appropriate table in the space below.

Turn over ►

Processing your data

6 Use a statistical test to analyse your data and test your null hypothesis. You may use a calculator and the Students' Statistics Sheet that is provided in this booklet.

You are provided with a sheet of graph paper. You may use this if you wish.

6 (a) State your null hypothesis.

.....
.....
.....
.....

(1 mark)

6 (b) Give your choice of statistical test.

.....

(1 mark)

6 (c) Give a reason for your choice of statistical test.

.....
.....
.....
.....

(1 mark)

6 (d) Carry out the statistical test and calculate the test statistic. Show your working.

(1 mark)

Turn over for the next question

Turn over ►

6 (e) Interpret the test statistic in relation to your null hypothesis.
Use the words *probability* and *chance* in your answer.

.....

.....

.....

.....

.....

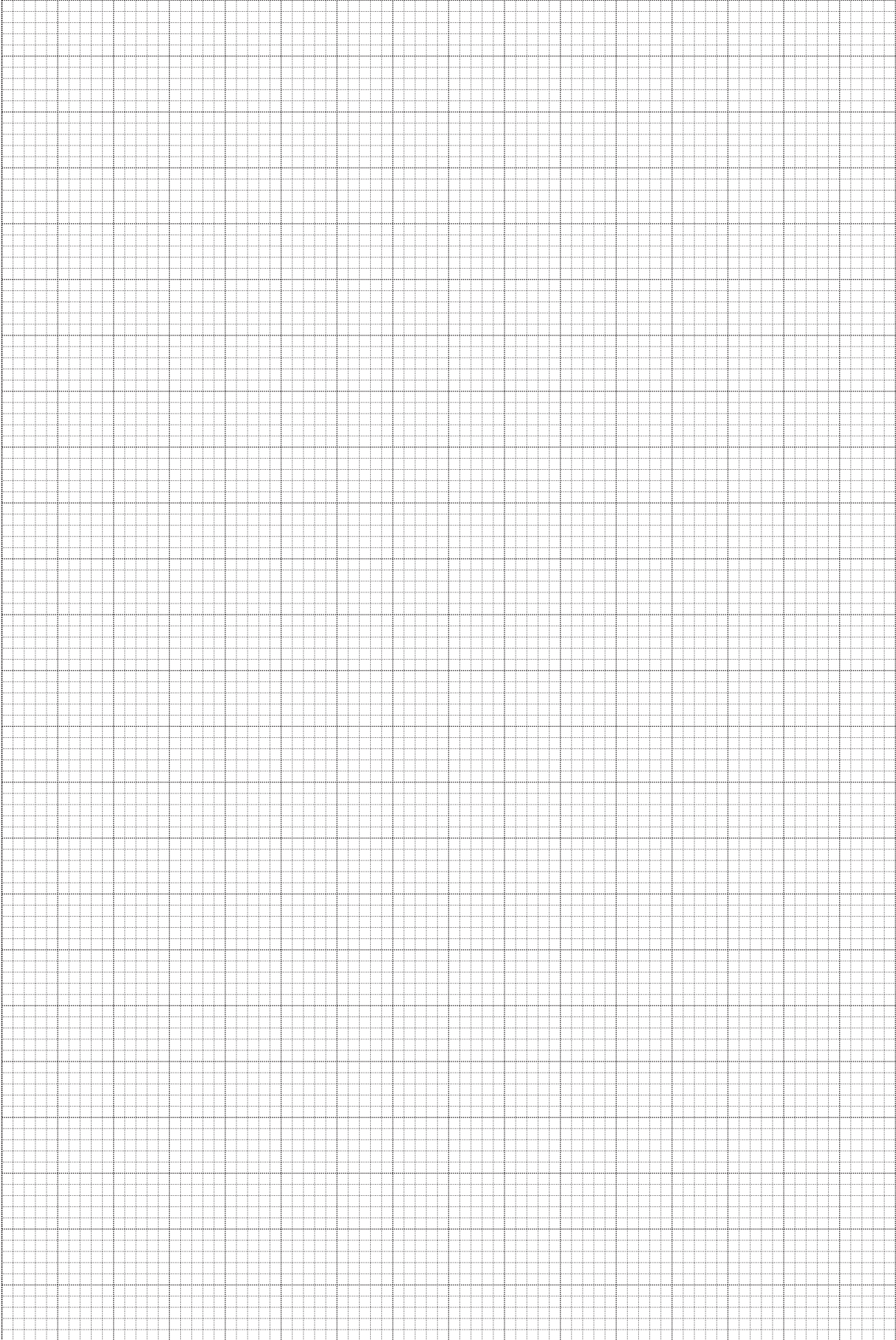
.....

(2 marks)

6

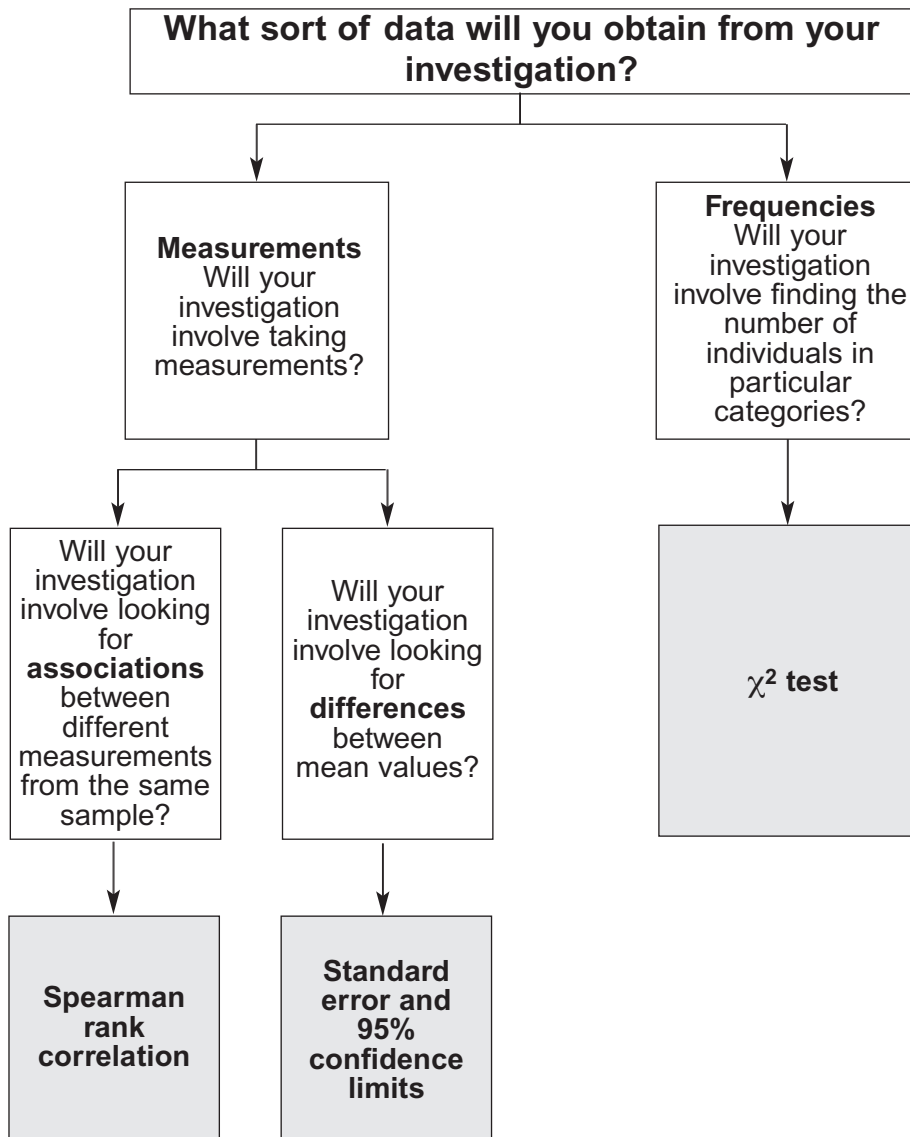
END OF TASK 2

You may use this if you wish.



Turn over ►

AQA Students' Statistics Sheet (version 3)



Standard error and 95% confidence limits

Calculate standard error, SE , for each sample from the following formula

$$SE = \frac{SD}{\sqrt{n}}$$

where SD = standard deviation
and n = sample size

95% confidence limits = $2 \times SE$ above and below the mean

For use in the ISA and EMPA assessment

The χ^2 test

The chi-square (χ^2) test is based on calculating the value of χ^2 from the equation

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

where O represents the results you observe in the investigation and E represents the results you expect.

Table showing the critical values of χ^2 at P = 0.05 for different degrees of freedom

Degrees of Freedom	Critical value
1	3.84
2	5.99
3	7.82
4	9.49
5	11.07
6	12.59
7	14.07
8	15.51
9	16.92
10	18.31

Spearman rank correlation test

Calculate the value of the Spearman rank correlation, r_s , from the equation

$$r_s = 1 - \left[\frac{6 \times \sum D^2}{n^3 - n} \right]$$

where n is the number of pairs of items in the sample and D is the difference between each ranked pair of measurements.

Table showing the critical values of r_s at P = 0.05 for different numbers of paired values

Number of pairs of measurements	Critical value
5	1.00
6	0.89
7	0.79
8	0.74
9	0.68
10	0.65
12	0.59
14	0.54
16	0.51
18	0.48

There are no questions printed on this page

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**

There are no questions printed on this page

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**

There are no questions printed on this page

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**