

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use Total Task 2



General Certificate of Education
Advanced Level Examination
June 2014

Biology

BI06X/PM2

Unit 6X A2 Externally Marked Practical Assignment
Task Sheet 2

To be completed before the EMPA Written Test.

For submission by 15 May 2014

For this paper you must have:

- a ruler with millimetre measurements
- a calculator.

Task 2

Introduction

You are going to investigate the movement of maggots.

In Task 2, you will investigate the relationship between the number of times a maggot changes direction and the time it takes the maggot to move off a piece of filter paper.

Materials

You are provided with:

- cardboard cover
- 10 maggots
- plastic teaspoon
- 10 filter papers
- access to a bowl of water at room temperature
- timer
- container for holding maggots after each trial.

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

Method

Read these instructions carefully before you start your investigation.

You should record a change of direction when the maggot changes the direction of movement of its whole body.

1. Soak a piece of filter paper in the water. Remove it and shake it gently to remove excess water. Lay this paper flat on the workspace in front of you.
2. Place a maggot at the centre of the filter paper using a plastic teaspoon.
3. Place the cardboard cover over the filter paper with the small observation hole uppermost.
4. Start the timer.
5. Record how many times the maggot changes direction before it moves off the filter paper.
6. Stop the timer and record the time taken for the maggot to move off the filter paper.
7. Remove the maggot and discard the filter paper.
8. Repeat steps 1 to 7 with the remaining 9 maggots.

If a maggot stops moving, remove it and repeat the trial with another maggot.

You will need to decide for yourself:

- how to determine the centre of the filter paper.

Recording your data

Record your raw data in an appropriate table in the space below.
There are no marks awarded for the table at A2.

Turn over for the questions

Turn over ►

Analysing your data

8 Use a statistical test to analyse your data and test your null hypothesis. You may use a calculator and the Students' Statistics Sheet that has been provided.

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

8 (a) State your null hypothesis. **[1 mark]**

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8 (b) Give your choice of statistical test. **[1 mark]**

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8 (c) Give the reason for your choice of statistical test. **[1 mark]**

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8 (d) Calculate the test statistic. Show your working.

[1 mark]

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

[2 marks]

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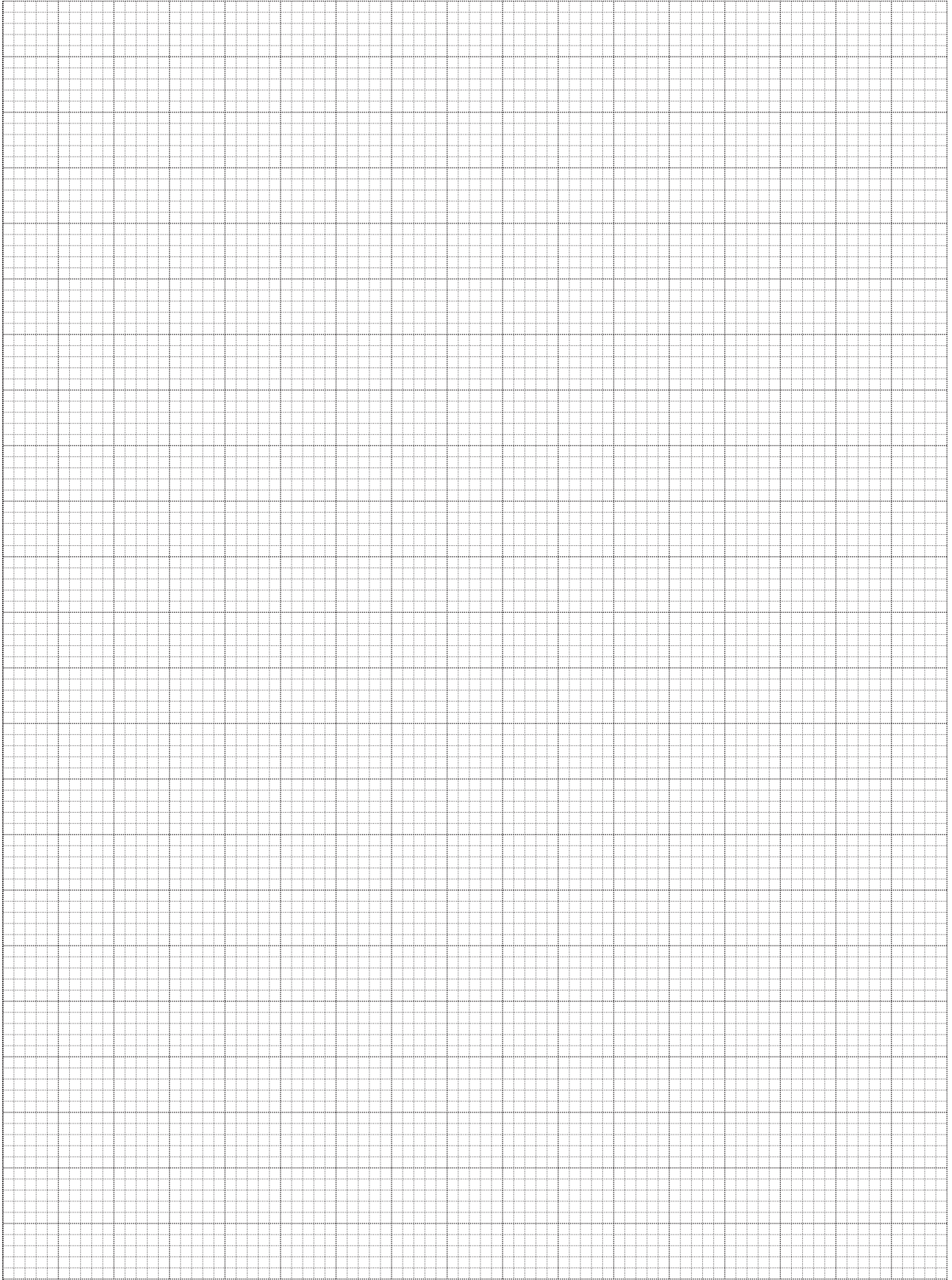
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END OF TASK 2

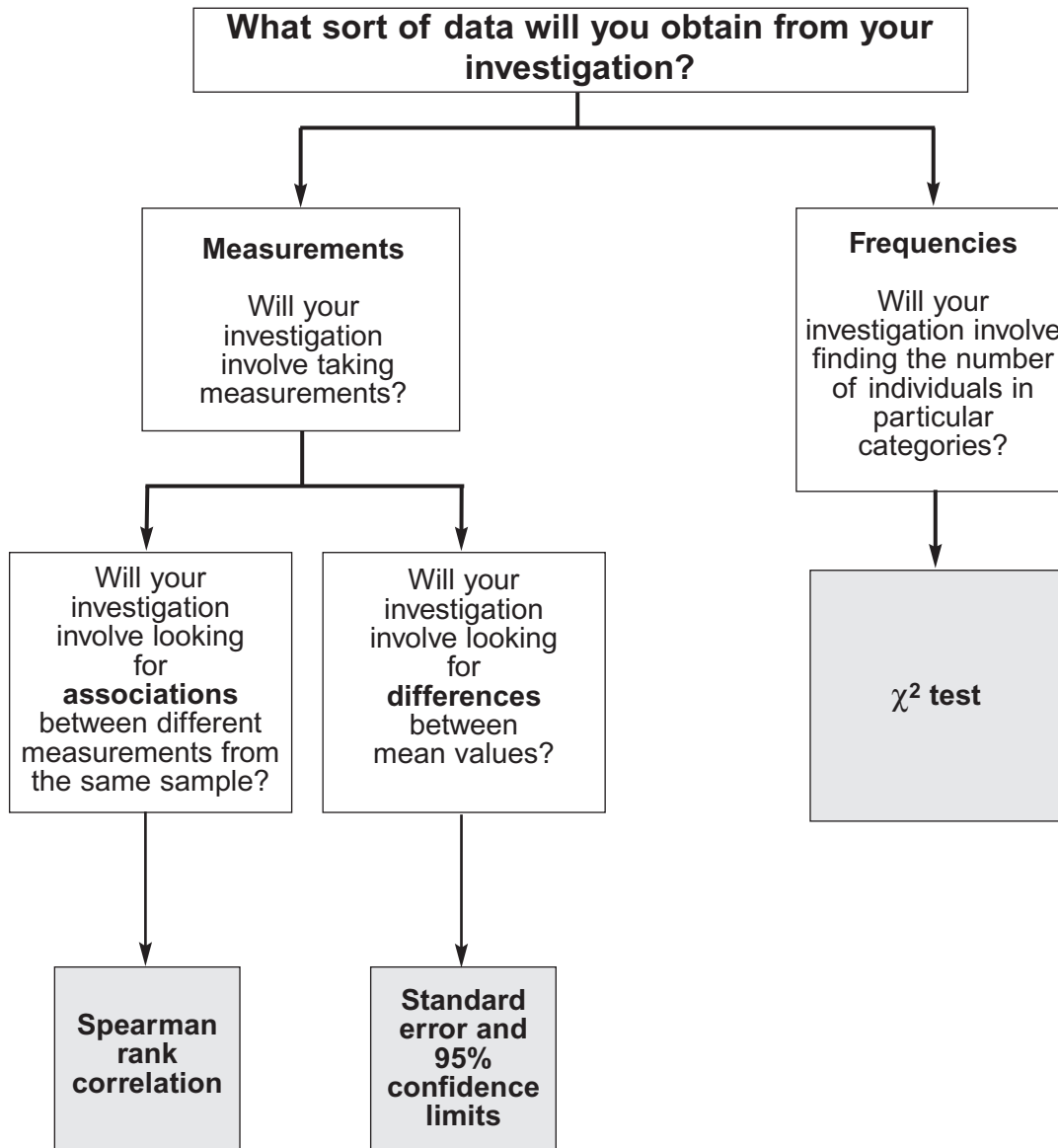
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Turn over ►

You may use this graph paper if you wish



AQA Students' Statistics Sheet (version 3)



Standard error and 95% confidence limits

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

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

where SD = the standard deviation
and n = sample size

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

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 pair of ranked 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

For use in the ISA and EMPA assessment