Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use
Total Task 2

General Certificate of Education
Advanced Level Examination
June 2012

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 2012

For this paper you must have:
- a ruler with millimetre measurements
- a calculator.

Task 2

Introduction

Parsnip seeds are very similar to hogweed seeds but are easier to obtain.
In this task you will look at the effect of the height at which parsnip seeds are released on the horizontal distance they travel.

Materials

You are provided with

- parsnip seeds
- piece of string with a weight tied to it. This is a plumb line.
- metre rule or tape measure
- stand and clamp
- piece of chalk
- 30 cm ruler with millimetre measurements.

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

Method

Read the following instructions carefully before you start your investigation.

1. Clamp a 30 cm ruler, horizontally, 1 metre above the floor. The free end of the ruler will be the release point for your parsnip seeds. Use the plumb line and piece of chalk to put a small mark on the floor immediately under the release point.

2. Drop a parsnip seed from the release point. Measure the distance from where the parsnip seed lands to the chalk mark.

3. Repeat step 2 until you have data for 20 parsnip seeds. You may assume that this is enough for a statistical test.

4. Repeat steps 1 to 3. This time, release the parsnip seeds at a height of 0.5 metre above the floor.

5. Record all your results in a suitable table.

You must decide for yourself

- how to standardise the task so that the parsnip seeds are always released in the same way.

Recording your data

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

Analysing your data

4 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 in this booklet.

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

4 (a) State your null hypothesis.

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(1 mark)

4 (b) Give your choice of statistical test.

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(1 mark)

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

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(1 mark)

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

(1 mark)

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

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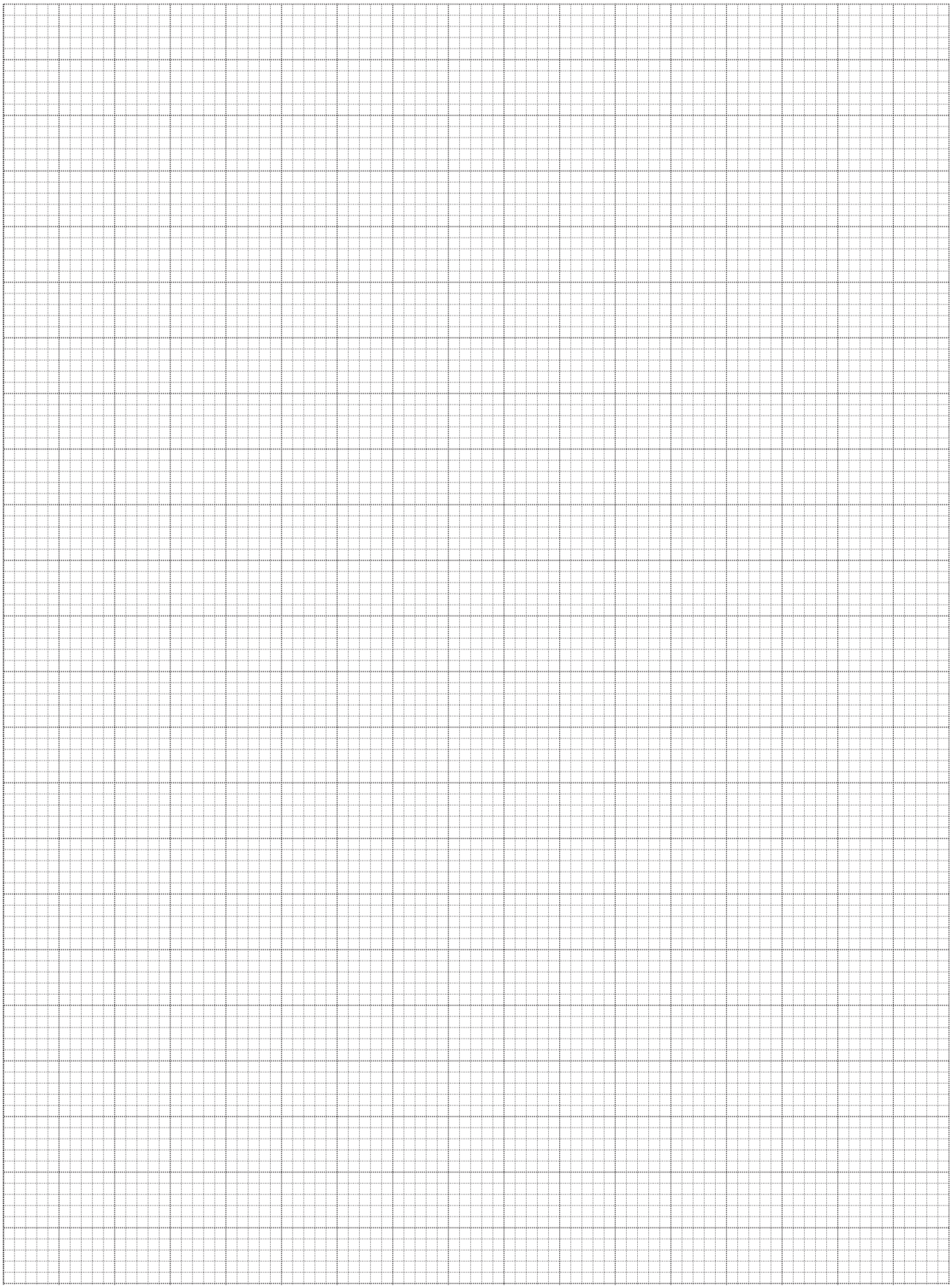
(2 marks)

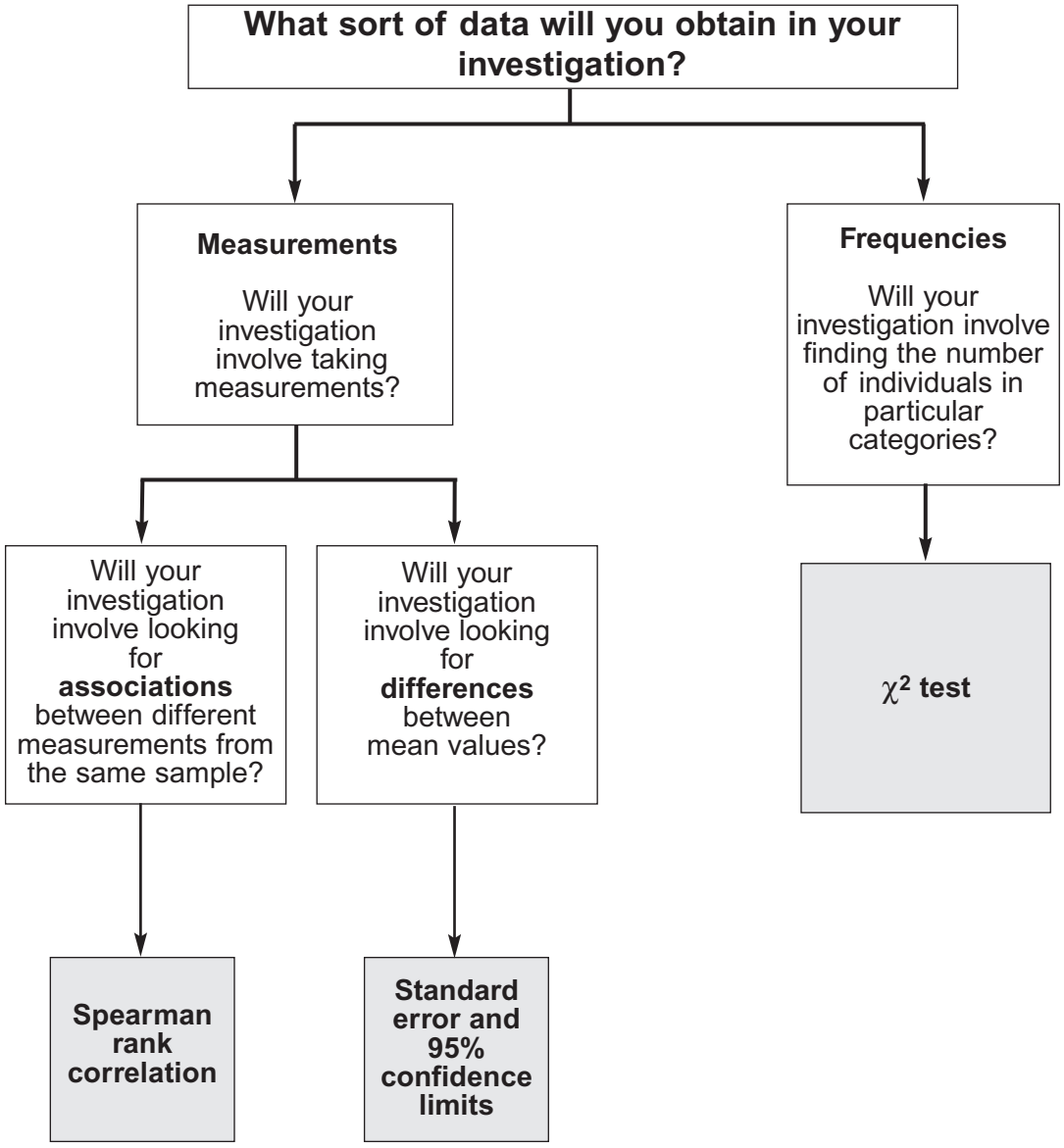
6

END OF TASK 2

You may use this 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

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

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

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

For use in the ISA and EMPA assessment