



General Certificate of Education
Advanced Level Examination
June 2012

Biology

BIO6X/TN

Unit 6X A2 Externally Marked Practical Assignment

Teachers' Notes

Confidential

To be given immediately to the teacher(s) responsible for GCE Biology

Open on receipt

Estimated Entries must be submitted to AQA in order for centres to receive hard copies of the materials to be used for candidates

Teachers' Notes

CONFIDENTIAL

These notes must be read in conjunction with *Instructions for the Administration of the Externally Marked Practical Assignment: GCE Biology* published on the AQA website.

The effect of the height at which seeds are released on the distance they travel

Materials

Task 1

Each candidate needs

- a ruler with millimetre measurements

Task 2

Each candidate needs

- 40 parsnip seeds. If candidates are instructed to pick up the seeds between trials, 20 seeds would be sufficient.
- piece of string, 1m in length with a weight attached to it. This will act as a plumb line.
- metre rule or tape measure
- stand and clamp
- piece of chalk to mark the floor under the release point
- 30 cm ruler with millimetre measurements.

Managing the investigation

If you have any queries about the practical work for this EMPA please contact your Assessment Adviser. Contact details can be obtained by emailing your centre name and number to biology-gce@aqa.org.uk. Please do not contact suppliers for advice.

This investigation is in two parts.

Task 1

Laboratory equipment or facilities are not required for this investigation.

Candidates are required to measure the lengths of 10 hogweed seeds, randomly selected from those shown on the photograph on page 3 of Task Sheet 1. Candidates must decide for themselves how to select the seeds at random. You must **not** give candidates any information about this or other aspects of the task.

Task 2

Candidates are required to investigate the effect of the height at which parsnip seeds are released on the distance they travel. Parsnip seeds are similar to hogweed seeds and are more easily obtained during the period of assessment. They may be purchased from a garden centre. A packet of parsnip seed contains approximately 300 seeds. If collected after the investigation, they may be used again.

The task should be carried out in conditions that allow for distribution of seeds. This could be inside, with open windows or fans to allow some air movement. The exercise does require a reasonable amount of space per candidate, anything less than 1 m² would cause difficulties.

Candidates must decide for themselves how to standardise the release of the seeds. You must **not** give candidates any information about this or other aspects of the task.

The tasks must be trialled before use.

Candidates must **not** be given information about the EMPA until one week before Task 1. One week before Task 1, teachers may give their candidates the following information.

You will investigate dispersal of seeds from the parent plant. You will also be asked about variation and competition.

There must be **no** further discussion and candidates must **not** be provided with any further resources to prepare for the assessment.

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use
Total Task 1



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Biology

BIO6X/PM1

Unit 6X A2 Externally Marked Practical Assignment Task Sheet 1

To be completed before Task Sheet 2.

For submission by 15 May 2012

For this paper you must have:

- a ruler with millimetre measurements
- a calculator.

Task 1

Introduction

Hogweed is a common plant found on roadsides. It grows between 0.5 and 2 metres high and produces large flat seeds at the top of the plant.

In this task you will investigate variation in hogweed seeds.

Materials

On page 3 you are provided with

- a photograph showing hogweed seeds. The photograph also shows a scale 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. On the photograph, select ten of the hogweed seeds at random.
2. Measure the length of each seed with your ruler.
3. Record your measurements in the table.

Seed number	Length of seed measured from the photograph / mm
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

You must decide for yourself

- how to select the seeds at random.



Questions on Task 1

Answer **all** questions in the spaces provided.

- 1 (a)** Describe how you selected the seeds at random.
- 1 (b)** Selecting the seeds at random prevents bias. Explain what is meant by bias in selecting seeds.
- 2 (a)** Use your ruler and the scale on the photograph to find the magnification of the seeds in the photograph. Explain how you arrived at your answer.
- 2 (b)** Calculate the actual length of seed 1. Explain how you arrived at your answer.
- 3 (a)** You could have calculated the standard deviation from your results. Explain why it would be more useful to know the standard deviation than the lengths of the smallest and largest seeds.
- 3 (b)** Hogweed seeds are normally shaken from the plant by gusts of wind. Explain how a large standard deviation in seed length affects the distances that the seeds land from the parent plant.

END OF TASK 1

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use
Total Task 2



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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

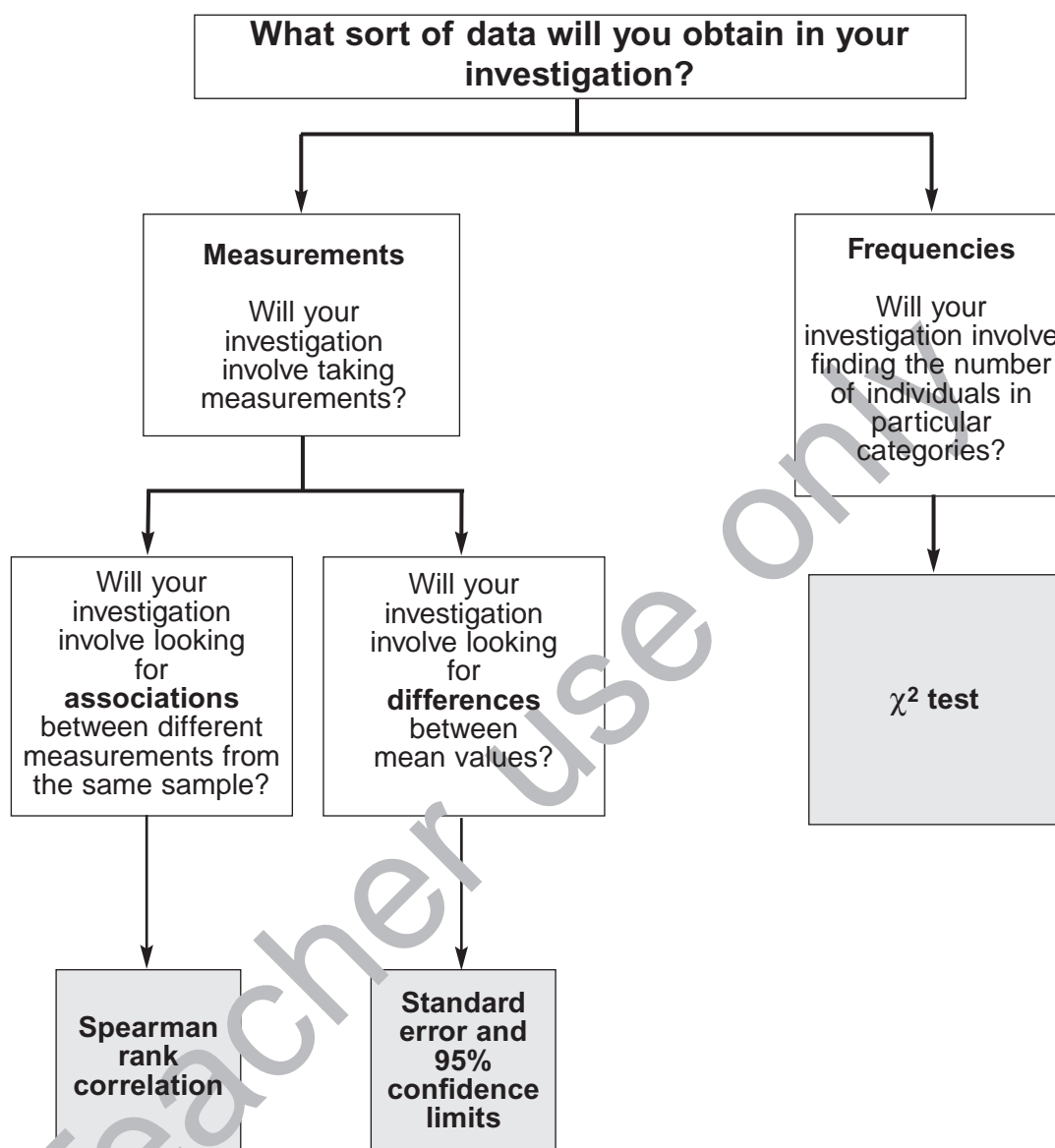
- 4 Use a statistical test to analyse your data and test your null hypothesis. You may use a calculator and the Students' Statistics Sheet that has been provided in this booklet.

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

- 4 (a) State your null hypothesis.
- 4 (b) Give your choice of statistical test.
- 4 (c) Give a reason for your choice of statistical test.
- 4 (d) Calculate the test statistic. Show your working.
- 4 (e) Interpret the test statistic in relation to your null hypothesis. Use the words *probability* and *chance* in your answer.

END OF TASK 2

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

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

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

For use in the ISA and EMPA assessment

Centre Number						Candidate Number					
Surname						Other Names					
Notice to Candidate. The work you submit for assessment must be your own. If you copy from someone else or allow another candidate to copy from you, or if you cheat in any other way, you may be disqualified.											
Candidate Declaration. I have read and understood the Notice to Candidate and can confirm that I have produced the attached work without assistance other than that which is acceptable under the scheme of assessment.											
Candidate Signature						Date					

For Examiner's Use Total EMPA mark	
Examiner's Initials	
Section	Mark
Task 1	
Task 2	
Section A	
Section B	
TOTAL EMPA MARK	



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Unit 6X A2 Externally Marked Practical Assignment Written Test

For submission by 15 May 2012

<p>For this paper you must have:</p> <ul style="list-style-type: none"> the Task Sheet 2, including your results and statistical calculations a ruler with millimetre measurements a calculator. 	<p>Time allowed</p> <ul style="list-style-type: none"> 1 hour 15 minutes
<p>Instructions:</p> <ul style="list-style-type: none"> Use black ink or black ball-point pen. Fill in the boxes at the top of this page. Answer all questions. You must answer the questions in the space provided. Do not write outside the box around each page or on blank pages. Do all rough work in this book. Cross through any work you do not want to be marked. 	<p>Information</p> <ul style="list-style-type: none"> The marks for questions are shown in brackets. The maximum mark for this paper is 34. You will be marked on your ability to: <ul style="list-style-type: none"> organise information clearly use scientific terminology accurately.

<p>Details of additional assistance (if any). Did the candidate receive any help or information in the production of this work? If you answer yes give the details below or on a separate page.</p> <p>Yes <input type="checkbox"/> No <input type="checkbox"/></p>
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Teacher Declaration:

I confirm that the candidate has met the requirements of the practical skills verification (PSV) in accordance with the instructions and criteria in section 3.8 of the specification.

Practical Skills Verification	Yes <input type="checkbox"/>
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Signature of teacher Date

As part of AQA's commitment to assist students, AQA may make your coursework available on a strictly anonymous basis to teachers, examining staff and students in paper form or electronically, through the Internet or other means, for the purpose of indicating a typical mark or for other educational purposes. In the unlikely event that your coursework is made available for the purposes stated above, you may object to this at any time and we will remove the work on reasonable notice. If you have any concerns please contact AQA.

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Section A

These questions are about your investigation of the effect of the height at which parsnip seeds are released on the distance they travel.

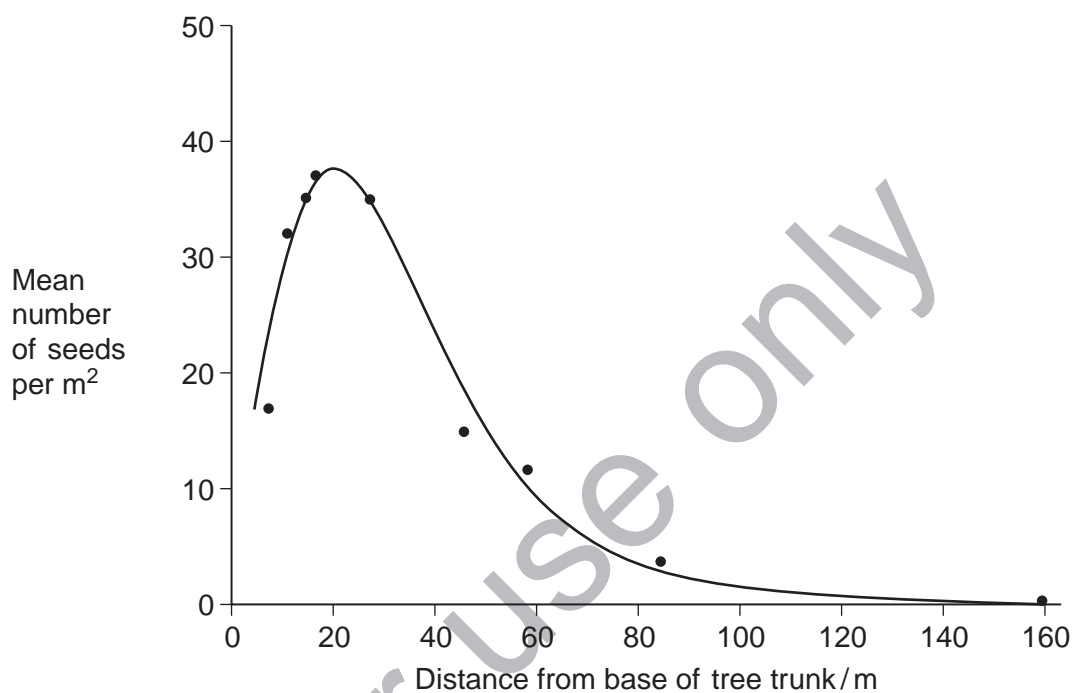
Use your copy of Task Sheet 2 and the results of your statistical analysis to answer them.

- 5 In **Task 2** you were told to standardise the way in which you released the parsnip seeds. Describe how you did this.
- 6 You used a plumb line in your investigation. Explain why using a plumb line would allow you to get reliable measurements.
- 7 In your investigation, wind speed was a confounding variable. Would using a large number of seeds help to minimise the effect of wind speed? Explain your answer.
- 8 A student suggested that it would be better to release all 20 seeds together.
- 8 (a) Suggest **one** advantage of releasing the seeds together.
- 8 (b) Suggest **one** disadvantage of releasing the seeds together.
- 9 Hogweed is a common plant found on roadsides. Hogweed seeds are very similar to parsnip seeds. Suggest **two** ways in which passing vehicles may assist the dispersal of hogweed seeds.

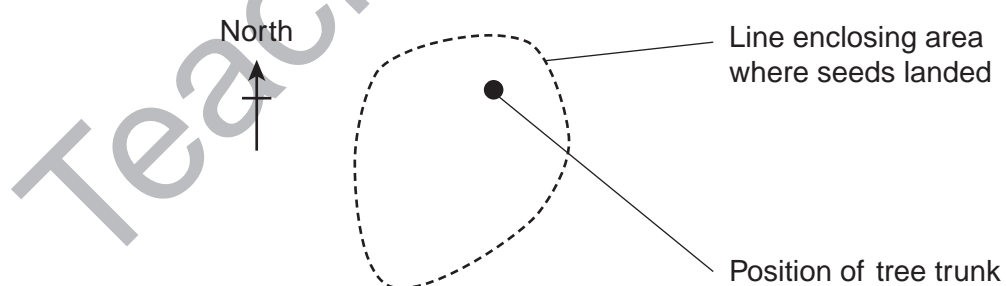
Resource Sheet

Resource A

A 75 m tall tree released very large numbers of small seeds. Ecologists used quadrats along a transect to measure the number of these seeds at different distances from the tree. Their results are shown on the graph.



The seeds of this tree are dispersed by wind. The diagram shows the pattern of seed dispersal from this tree.



Resource B

Agricultural scientists divided a field into a number of different plots. They planted soya bean seeds in these plots at different sowing densities. The diagram shows how these plots were arranged. The numbers show the sowing densities in seeds per m^2 . The plots containing seeds sown at a density of 250 seeds per m^2 have been shaded.

250	500	1000	15	25	50	100
15	25	50	100	250	500	1000
25	50	100	250	500	1000	15
50	100	250	500	1000	15	25
1000	15	25	50	100	250	500
500	1000	15	25	50	100	250
100	250	500	1000	15	25	50

The scientists recorded the number of soya bean plants growing in each plot at different times after the start of the investigation. Their results are shown in the table.

Number of seeds planted per m^2	Mean number of plants surviving per m^2 after			
	22 days	39 days	61 days	93 days
15	15	15	15	15
25	24	24	24	23
50	47	46	46	41
100	98	96	96	87
250	246	242	204	196
500	492	486	313	124
1000	987	788	276	95

Section B

Use the information in the **Resource Sheet** and your own knowledge to answer the questions.

Answer **all** questions in the spaces provided.

Use **Resource A** to answer **Questions 10 to 12**.

- 10** Describe how the ecologists could have used quadrats and a transect to obtain the data from which the graph was drawn.
- 11** Look at the diagram showing the pattern of seed dispersal from this tree.
- 11 (a)** Suggest an explanation for the shape of the line enclosing the area where the seeds landed.
- 11 (b)** The line enclosing the area where the seeds landed would be different for trees of this species that were of a different height. Suggest why.
- 12** In an ecological succession, trees that are pioneer species often have smaller seeds than those that are part of a climax community.
- 12 (a)** The species of tree in this investigation is adapted to colonising areas that have been cleared of vegetation. Use information from **Resource A** to explain how.
- 12 (b)** The seeds produced by this species of tree did **not** grow successfully in a climax community. Suggest why.

Use **Resource B** to answer **Questions 13 to 15**.

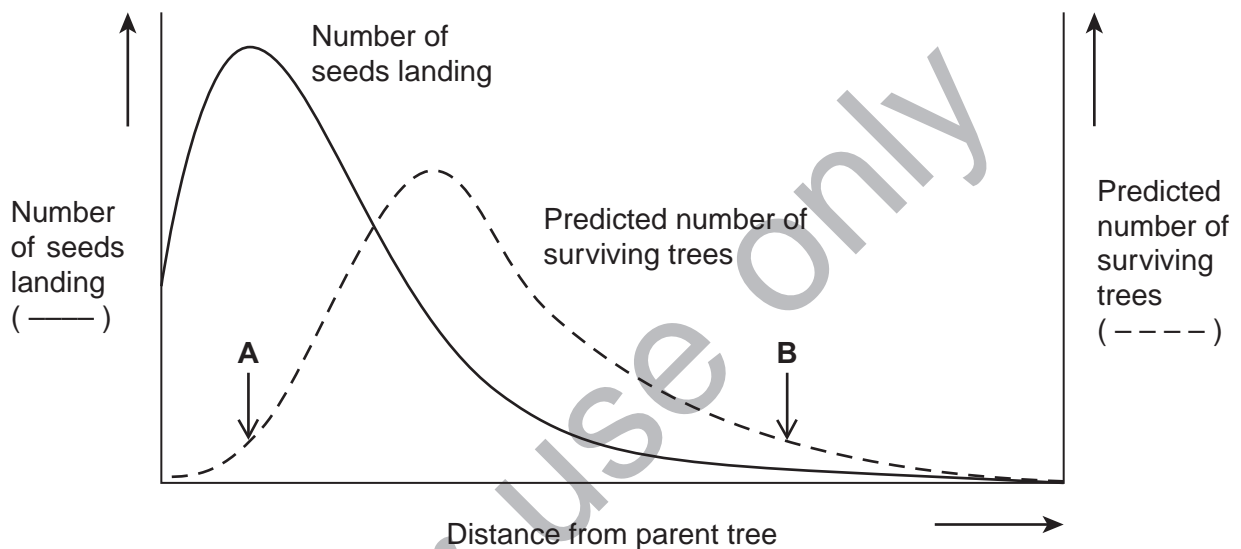
- 13 (a)** In terms of rows and columns, describe how the plots containing seeds sown at a density of 250 m² were arranged.
- 13 (b)** Explain the advantage of arranging the plots in this way.
- 14** The scientists would have treated the plots in the same way. Suggest **two** ways in which the scientists would have treated the plots to ensure that confounding variables would **not** affect the results.

- 15 (a)** Describe the results of this investigation.
- 15 (b)** Explain the results when 1000 seeds were planted per m^2 .

Use **Resources A** and **B** and your own knowledge to answer Question 16.

- 16** A scientist measured the number of seeds landing at different distances from a parent tree. He then produced a theoretical model. He used this model to predict how the number of new trees that grew from the seeds and survived varied with distance from the parent tree. The scales used for the two vertical axes are different.

The predictions from this model are summarised in the graph.



- 16 (a)** Explain why the model predicts a low number of surviving trees at point **A**.
- 16 (b)** Explain why the model predicts a low number of surviving trees at point **B**.

END OF QUESTIONS