

Centre Number						Candidate Number				
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For Teacher's Use	
Section	Mark
1	
2	
<b>TOTAL</b> (Max 34)	



General Certificate of Secondary Education  
June 2011

# Environmental Science

# 44402

## Unit 2 Investigations in Environmental Science ISA 1 – Fieldwork Investigation

Valid for submission in May 2011

**For this paper you must have:**

- results tables and charts or graphs from your own investigation
- You may use a calculator.

**Time allowed**

- 45 minutes

**Instructions**

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in **Section 1** and **Section 2**.
- You must answer the questions in the spaces 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.

**Information**

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 34.
- You are expected to use a calculator where appropriate.
- In some questions you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Signature of teacher

marking this ISA: ..... Date: .....



J U N 1 1 4 4 4 0 2 0 1

**Section 1**

These questions are about your fieldwork investigation that you did, related to the distribution of pollution in an area.

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

**1** In your investigation what was:

**1 (a)** the **independent** variable (the one that you deliberately changed)

.....  
.....  
(1 mark)

**1 (b)** the **dependent** variable?

.....  
.....  
(1 mark)

**2 (a)** State **one** thing that you **measured** during your investigation.

.....  
(1 mark)

**2 (b)** What equipment did you use to make this measurement?

.....  
(1 mark)

**3** Why was it advisable to take several measurements at each sample site, rather than just one?

.....  
.....  
(1 mark)

**4 (a)** Name **one** other variable which may have affected your results.

.....  
(1 mark)

**4 (b)** Suggest **one** reason why this variable may have affected your results.

.....  
.....  
(1 mark)



4 (c) Explain what you did to control or take account of this variable.

.....  
.....

(1 mark)

5 Were there any random errors in your results?  
Draw a ring around your answer.

**Yes / No**

Use your data to give a reason for your answer.

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

(1 mark)

6 Look at your own results table or graph or chart.

6 (a) Make **one** simple statement linking the two variables that you were investigating.

.....  
.....

(1 mark)

6 (b) Explain the link between the two variables that you have stated.

.....  
.....  
.....  
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(2 marks)

7 Make sure that your results table and graphs or charts are handed in with this paper.  
You will be awarded up to 6 marks for these.

(6 marks)

18

**Turn over for the next section**

**Turn over ►**



## Section 2

These questions are based on a theme similar to your own investigation.  
The information is based on a real situation.  
In some questions you will be required to link your own investigation methods or results  
to this new situation.

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

### Background information

A team of environmental scientists investigated air pollution for a local council.  
They did this by studying lichens growing on gravestones in churchyards.

Lichens (which look like small plants) are affected by sulfur dioxide, produced when fossil fuels  
are burned. Few lichen species can survive in heavily polluted areas.

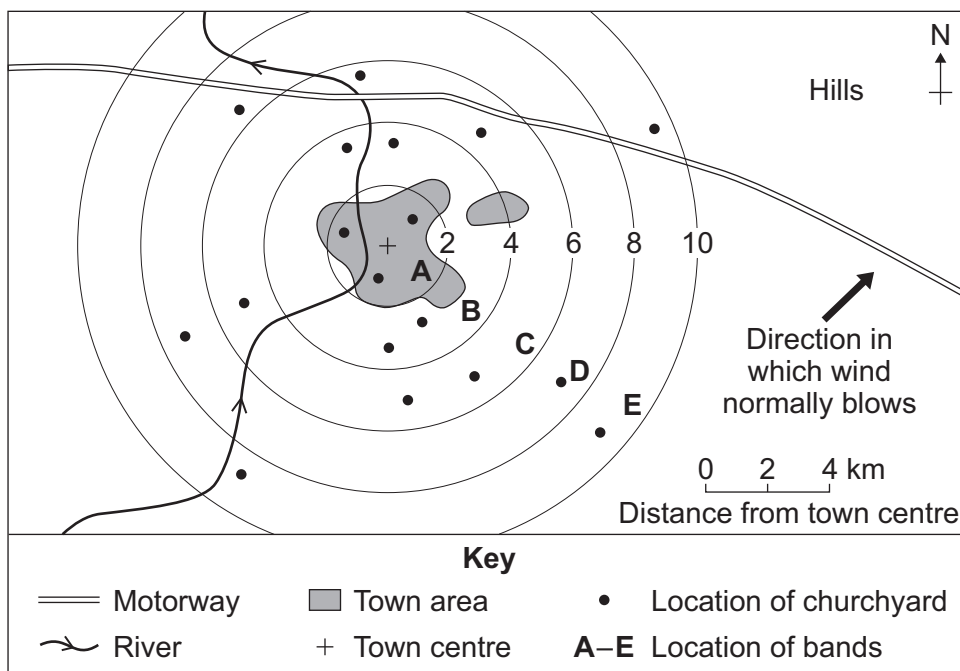
The **hypothesis** for the investigation was:

*'The further away from the town centre that you travel, the greater is the lichen cover on  
gravestones.'*

This was the **method** which the scientists used:

- they studied lichens in 18 churchyards
- the churchyards were grouped into bands (**A**, **B**, **C**, **D** and **E**) according to the distance from the town centre
- they chose one gravestone at random in each churchyard and estimated the total area of lichen cover on the gravestone as a percentage of the total surface area of the gravestone
- they calculated the mean percentage lichen cover for each band (**A**, **B**, **C**, **D** and **E**)

The map shows where the churchyards were located.



8 What type of variable is *distance from the town centre*?

Tick (✓) the box beside the correct answer.

Categoric variable

Control variable

Independent variable

Discrete variable

(1 mark)

9 The scientists chose three churchyards to study within band **A**.

Why was it better to choose three churchyards rather than just one?

You may use what you have learned from your own investigation to help you to answer this question.

.....  
.....

(1 mark)

10 The scientists banded together churchyards at similar distances from the town centre (five different distance bands altogether). In each band, **A, B, C, D** and **E**, the mean percentage lichen cover was calculated.

Suggest **one** reason why this form of banding might produce wrong conclusions about patterns of pollution.

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(1 mark)

Turn over for the next question

Turn over ►



The data collected by the scientists is shown in the table.

Churchyard locations	Mean distance from town centre, in kilometres	% lichen cover in each churchyard in the band	Mean % lichen cover
Band A	1	10, 4, 7	7.0
Band B	3	33, 27, 47, 39	36.5
Band C	5	45, 68, 43, 15, 39	42.0
Band D	7	32, 28, 67	42.3
Band E	9	75, 72, 68	

11 Calculate the mean value for lichen cover using all data in the distance band **E**.

Write your answer in the box in the table.

(1 mark)

12 (a) Describe **one** pattern or trend that you can see in the results.

.....  
.....

(1 mark)

12 (b) Suggest an explanation for this pattern or trend.

.....  
.....  
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(2 marks)

13 The concentration of pollutants may not be the only variable affecting the distribution of lichen.

Suggest **two** other variables that might influence the distribution of lichen in the study area.

1 .....

2 .....

(2 marks)

14 Suggest **one** way in which the conclusions from the scientists' investigation could be used to help to reduce air pollution in the town studied.

.....  
.....

(1 mark)



**15** After this field investigation, the scientists wanted to carry out a second set of observations to help to interpret their results. They planned to use a meter to measure the levels of sulfur dioxide pollutant over the same area.

**15 (a)** Suggest and explain **one** advantage of carrying out this second investigation.

You may use what you have learned from your own investigation to help you to answer this question.

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

(2 marks)

**15 (b)** Using ideas from your own fieldwork investigation, describe how the scientists should carry out the second investigation.

You should include statements on how it can be made a **fair** investigation. You should also show how to minimise errors to obtain reliable results.

*In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

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(4 marks)

16

**END OF QUESTIONS**



**There are no questions printed on this page**

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

