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General Certificate of Secondary Education  
Specimen Paper

## Environmental Science

## 44402

**Unit 2 Investigations in Environmental Science**  
**Specimen ISA Paper**  
**Solar Cells**

For Teacher's Use	
Section	Mark
1	
2	
Total (max 34)	

**Valid for submission in XXXX**

**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.
- You must answer the questions in the space provided. Answers written in margins or on blank pages will not be marked.
- 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

The specimen assessment materials are provided to give centres a reasonable idea of the general shape and character of the planned question papers and mark schemes in advance of the first operational exams.

## 44402

## Section 1

These questions are about the investigation that you carried out on solar cells.  
Answer **all** questions in the spaces provided.

**1** In your investigation, the **independent** variable (the one that you deliberately changed) was the area of solar cell exposed to the light.

**1** (a) What was the **range** that you used for this variable?

The range was from..... to.....

*(1 mark)*

**1** (b) Was this a suitable range to choose?  
Draw a ring around your answer.

**Yes / No**

Explain your answer.

.....  
.....

*(1 mark)*

**2** What was the **dependent** variable in your investigation?

.....  
.....

*(1 mark)*

**3** Did you repeat any of your readings?  
Draw a ring around your answer.

**Yes / No**

Explain why you did or did not repeat any readings.

.....  
.....

*(1 mark)*

**4** The **sensitivity** of the meter that you used depends on the smallest change in the reading that can be recorded.

**4** (a) Look at the table of results.

What was the smallest scale division on the meter?

.....

*(1 mark)*



Barcode

4 (b) If you had used an instrument with a smaller scale division, what would this have increased?  
Draw a ring around the correct answer.

**accuracy**                      **precision**                      **reliability**                      **validity**

(1 mark)

5 Before you carried out your investigation, you may have carried out a preliminary trial.  
Why is this a good thing to do in this investigation?

.....  
.....

(1 mark)

6 Look at your results table and graph or chart.

6 (a) What conclusion can you make from your investigation about a link between the area of the cell exposed and the voltage output?

.....  
.....

(2 marks)

6 (b) Use your results to justify the conclusion that you have reached.

.....  
.....

(2 marks)

7 Suggest **one** improvement that you could make that would increase the **accuracy** of your results.

.....

(1 mark)

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

(6 marks)



## Section 2

These questions are based on a vocational application of your own investigation. In some questions you will also be required to relate your own method/results to this new context.

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

A work experience student was sent to a company that supplies solar panels to power road signs in remote areas.

He noticed that different customers used different sizes of panel, and wondered why. He decided to find out how the **voltage** produced depends on the **area** of solar panel.

- 9 Using ideas from your own investigation into solar cells, explain how the student should carry out this investigation.

You should write down the method in such a way that the student would be able to follow your instructions and obtain valid results.

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

(4 marks)



The student carried out the investigation and obtained the results shown in the table

**Table of Results**

Surface area exposed (cm <sup>2</sup> )	Average voltage in millivolts (mV)
0.0	10
5.0	50
20.0	90
30.0	105
50.0	110
100.0	120
120.0	140
140.0	150
200.0	160
250.0	170
500.0	175

**10** There seems to have been a **zero error** on the voltmeter.

**10** (a) How can you tell this from the table of results?

.....  
 (1 mark)

**10** (b) If you had a zero error on the instrument that you used in your investigation, what should you have done to obtain accurate results from it?

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

**11** In your investigation, in addition to the independent and dependent variables, there were other variables that you needed to keep unchanged

Write down **one** variable that the student should have kept unchanged

.....  
 (1 mark)

**12** Look at the first column in the table of results, headed **Surface area exposed**.

What type of variable is this?  
 Draw a ring around the correct answer.

- continuous                      categoric                      discrete                      ordered**

(1 mark)



13 The student's supervisor said that the results were badly reported.  
He said that the student had only recorded the **average** voltage produced.

13 (a) Why is it important to show the results of the individual tests?

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

13 (b) In fact the student had done each test 3 times.

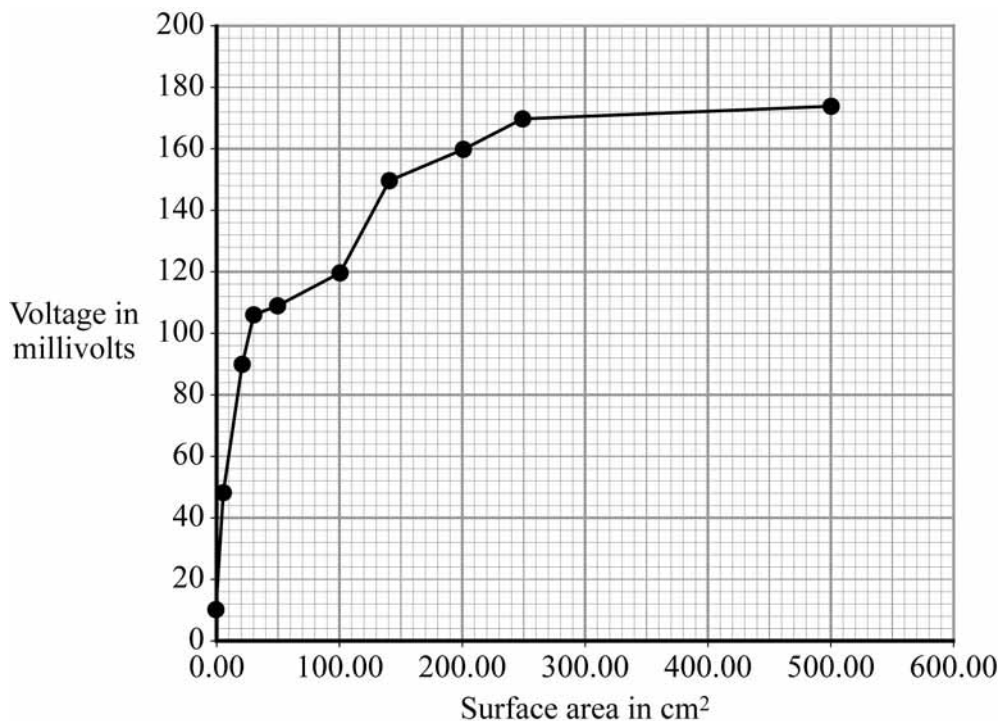
In your own investigation you were required to carry out several repeats and then calculate a mean.

Explain how you calculated a mean from the repeat values.

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

14 The student produced a graph of these results, see **Chart 1**.

**Chart 1**



14 (a) Explain why the student should have taken more readings between 50.0 cm<sup>2</sup> and 150.0 cm<sup>2</sup>.

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

14 (b) The line on the graph that the student has drawn is not a line of best fit. Draw a line of best fit on the graph.

(1 mark)

14 (c) Compare the results of **your** investigation with those of the student. Write down **one** way in which they are similar and **one** way in which they are different.

Similarity .....  
.....  
Difference .....  
.....  
(2 marks)

15 The student was asked to suggest a few words for the company’s brochure.

He wrote: ‘We recommend that you purchase a 500 cm<sup>2</sup> panel rather than a 250 cm<sup>2</sup> panel. As you can see from the charts, you get an increased voltage from a larger surface area. The panels cost £10 per 100 cm<sup>2</sup>.’

15 (a) Write down **one** reason why this might **not** be good advice.

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

15 (b) Why do you think that the company might be keen to make this recommendation?

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

END OF QUESTIONS



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