Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

Leave Blank	
For Teacher's Use	
Section	Mark
1	
2	
TOTAL (Max 34)	

General Certificate of Secondary Education
June 2011

Environmental Science 44402

Unit 2 Investigations in Environmental Science
ISA 2 – Laboratory 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: .....

Section 1

These questions are about your investigation on the effectiveness of insulating materials for energy saving.

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

1 Before you started your investigation you did a risk assessment to make sure that all work was done safely.

1 (a) State **one** risk which you identified.

.....

(1 mark)

1 (b) How did you 'reduce' this risk?

.....

.....

(1 mark)

2 One of the variables which you measured in your investigation was temperature.
Which **one** of these words best describes your temperature variable?
Draw a ring around your answer.

controlled **continuous** **categoric**

(1 mark)

3 In your investigation what was your **independent** variable (the one that you deliberately changed)?

.....

.....

(1 mark)

4 Study your own results table and graphs or charts.
What did you conclude from your investigation about the link between the **independent** and the **dependent** variable?

You should quote figures from your own data to support your answer.

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(3 marks)

5 Different people or groups in the class may have obtained different results from the same investigation.
Give **one** possible reason for these differences in results.

.....

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(1 mark)

6 Explain **one** way in which you could check the reliability of your investigation.

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(2 marks)

7 People in your local area want to save money on heating their houses.
Explain how the conclusions from your investigation about insulating materials could help people to reduce their energy bills.

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(2 marks)

8 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

Section 2

These questions are based on a commercial use of your own type of investigation.
Where relevant you should make references to your own work and results in the answers.

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

Background information

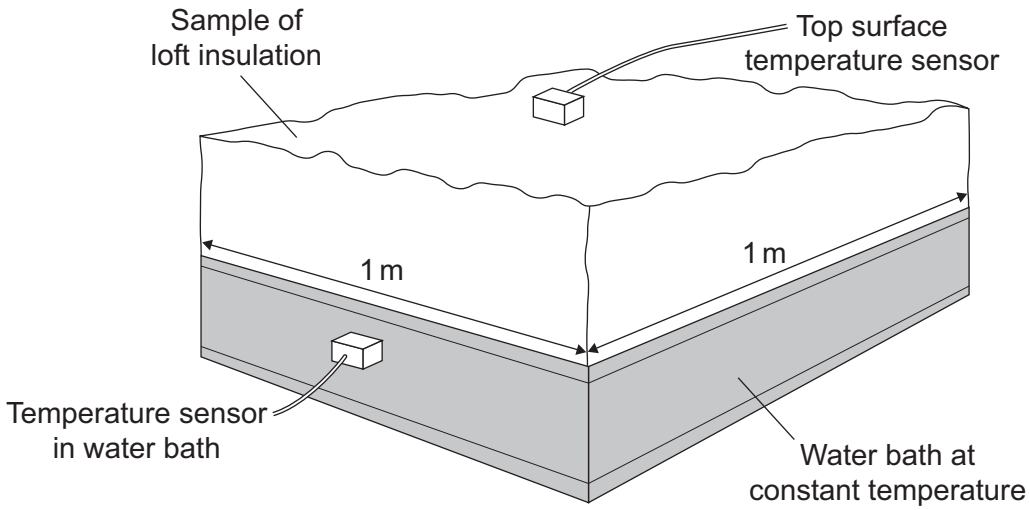
A local store 'Ekostrukt' is selling two types of environmentally-friendly loft insulation material in different thicknesses.

These are:

- Minwoolins (fibres from rocks treated at high temperatures)
- Lamwoolins (sheep's wool).

Scientists working for 'Ekostrukt' tested samples of these materials in a laboratory. Customers can look at these results.

The diagram and information below give details of how the scientists did their tests.



- A sealed tank of water in the laboratory was kept at a constant temperature of 20 °C.
- The scientists tested three different thicknesses of each type of insulation. They tested three samples of each thickness.
- Each sample of the insulating materials was placed on top of the tank.
- One temperature sensor was placed in the water tank and another sensor was placed in the centre of the top surface of the sample.
- When the two temperatures were constant the scientists calculated the rate at which heat passed through the insulation. That value is the 'U value'.
- The lower the U value, the better the insulation.

9 The pieces of material which were tested were selected by **random sampling**.
What is meant by random sampling?

.....

.....

(1 mark)

10 There are many variables which need to be controlled in this test.
Suggest **two** control variables and explain why each needs to be kept constant.

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

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)

Turn over ▶

11 The table shows the results of the scientists' tests.

Type of material		**Minwoolins**			**Lamwoolins**		
Sample thickness in mm		100	200	300	100	200	300
U values (in arbitrary units)	Test 1	0.23	0.34	0.13	0.41	0.27	0.15
	Test 2	0.21	0.09	0.09	0.39	0.29	0.13
	Test 3	0.22	0.11	0.11	0.37	0.22	0.11
Mean U value		0.22	0.18	0.11	0.39	0.26	

11 (a) Calculate the **mean U value** for 300 mm thickness of Lamwoolins and write it in the table.

(1 mark)

11 (b) One result in the table appears to be anomalous.

11 (b) (i) Circle the anomalous result in the table.

(1 mark)

11 (b) (ii) From experience of your own investigation, what should the scientists have done before calculating a mean value?

.....

.....

(1 mark)

11 (c) (i) Using the mean U values, what thickness of which material showed the best insulating properties?

..... mm thickness of ..... material showed the best insulating properties.

(1 mark)

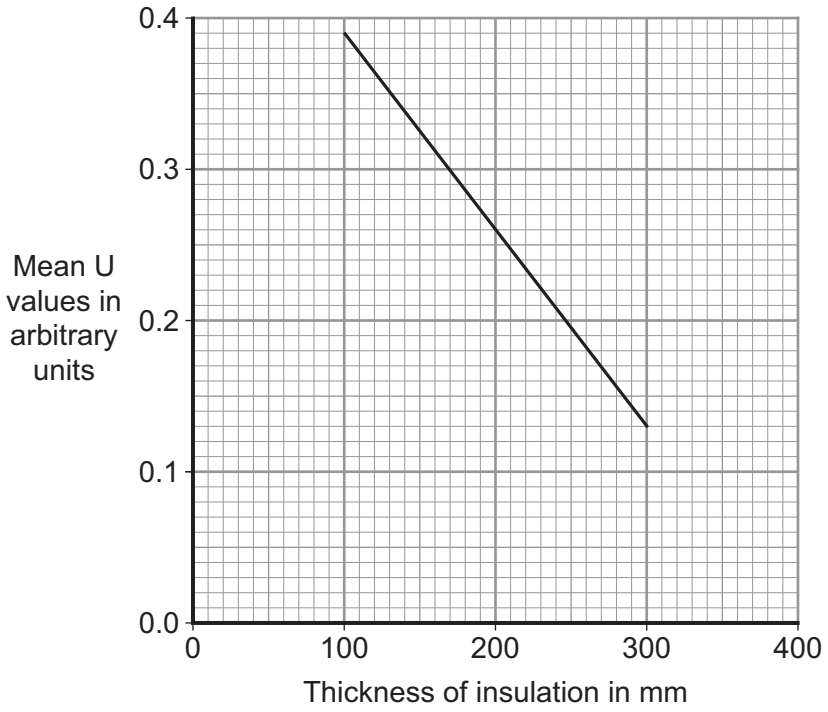
11 (c) (ii) Suggest **one** reason why you think this sample has the best insulating properties. You may use what you have learned from your own investigation to help you to answer this question.

.....

.....

(1 mark)

12 The scientists drew a graph of their results for Lamwoolins insulation.



12 (a) What does the graph show about the relationship between the thickness of insulation material and U values?

.....

.....

.....

.....

(2 marks)

12 (b) Use the graph to estimate the thickness of Lamwoolins needed to obtain a U value of 0.08.

The estimated thickness of Lamwoolins is ..... mm.

(1 mark)

Turn over ▶

13 The scientists could have used five temperature sensors on top of the insulation material instead of just one. They would have taken a mean value of the five temperature readings to calculate the U value for each sample.

What difference would that have made to the results?

Tick (✓) the correct box.

Results would be more valid ☐

Results would be more precise ☐

Results would be more reliable ☐

(1 mark)

14 Your knowledge of the properties of insulating materials can be used to answer this question.

14 (a) Suggest **one** reason why it is important for customers to know the U value of insulation materials.

.....

.....

(1 mark)

14 (b) Lamwoolins has good insulating properties. State **one** environmental reason why people might choose Lamwoolins rather than Minwoolins for their loft insulation.

.....

.....

(1 mark)

16

END OF QUESTIONS