General Certificate of Secondary Education
June 2011

Environmental Science 44402/TN

Unit 2 Investigations in Environmental Science

Teachers' Notes Confidential

Investigative Skills Assignments (ISAs)

- **ISA 1 – Fieldwork Investigation**
- **ISA 2 – Laboratory Investigation**

Valid for Moderation in June 2011

For immediate release to the teacher(s) responsible for GCSE Environmental Science

All controlled assessment marks to be returned to AQA by 7 May 2011

Open on receipt

Introduction

1 The Investigative Skills Assignments (ISAs) will be available to Examinations Officers (EO) in April 2010. The EO may print out **one** copy of the ISAs for the use of the Head of Environmental Science but this copy **must** be kept under secure conditions.

2 The ISA papers should **not** be downloaded on to the centre's intranet, neither should any electronic copies be made.

3 Teachers' Notes are sent out in advance of the ISA papers so that teachers can incorporate the ISAs into their schemes of work.

4 Candidates may attempt one or both of the ISAs supplied by AQA, and submit the best mark to AQA. Candidates may **not** attempt an ISA more than once. **ISAs are re-issued each year and are valid for one year only**.

5 **Do not use the 'live' ISAs for practice purposes**. These ISAs may be used for practice from September 2011.

6 Candidates should be entered in February for controlled assessment moderation in the following June.
A mark is not needed at the time of entry but should be submitted to AQA and the moderator by 7 May. The marks must be submitted on the Centre Mark Form (CMF). The centre should also circle the highest and lowest non-zero mark for each subject on the CMFs.

7 The teacher should ensure that the PSA mark has been added to the ISA mark to make a total controlled assessment mark.

8 The entry code for Unit 2 (controlled assessment) is **44402**.

9 The entry code for certification in Environmental Science is **4442**.

10 ISAs require candidates to use information from their own experiment to answer some of the questions in Section 2. Consequently, as far as possible, centres should use tasks **very similar** to the ones detailed in the Teachers' Notes.

11 Further information about conducting the ISA can be found in the 'Guidance Notes for Controlled Assessment' accessed through the Teacher Resource bank for GCSE Environmental Science.
http://www.aqa.org.uk/qual/newgcses/science/new/env_science_materials.php?id=03&prev=03#

GCSE Environmental Science ISA

ISA 1 – Fieldwork Investigation – Teachers' Notes

Valid for submission in June 2011

This ISA relates to Section A: Population and Sustainability and Section B: The Management of Water Resources

Area of investigation
This work should be carried out during the teaching of the section relating to two topics in Environmental Science:

A2.3: Why is the use of fossil fuels unsustainable?
Environmental scientists know that easily-accessible supplies of fossil fuels are running out and that their combustion releases pollutants into the atmosphere. Candidates should know and understand that the current rate of use of fossil fuels is unsustainable because their combustion releases the greenhouse gas, carbon dioxide. Combustion may also release nitrogen oxides, sulfur oxides, carbon monoxide and particles which are associated with poor human health and air pollution.
and
B2.1: How is water allocated to different uses in the UK?
Candidates should be aware that the demand for many different uses of water is increasing. Supplies of water are variable and the quality of water may be affected by human activities. They should know and understand that the Environment Agency is the UK Government Organisation that manages water resources, which includes care of the aquatic environment, supply monitoring, flood prevention and pollution control.
The practical activity based on these two topics should enable candidates to show their ability to:

- measure and record one or more indicators of environmental pollution
- demonstrate personal knowledge of working safely and show due regard for the well-being of living organisms
- show awareness of likely long-term effects of pollution
- sample the environment using a transect or random sampling
- survey indicator organisms to assess air / water quality
- draw conclusions about distribution of pollutants, deduce possible causes and suggest possible solutions.

It should also give them an opportunity to become familiar with particular problems of pollution in their local area and to study a local council's response to reducing their impact on the environment.

Section 2 of the ISA will relate to environmental scientists working for a Local Authority in Britain, and will give candidates the opportunity to demonstrate their understanding of the need for such agencies to:

- identify differences in levels of pollution and recognise patterns
- identify the most threatened areas by determining the concentration of pollutants
- measure chemicals in rainwater and survey living organisms as indicator species to identify the level and effect of pollution
- propose ways of reducing pollution
- evaluate the success of current anti-pollution policies.

Risk assessment
It is the responsibility of the centre to ensure that a risk assessment is carried out before students commence any fieldwork.

The Practical Work
For this part of the investigation candidates may work individually or in groups.

A suggested outline is given and, as far as possible, centres should use a task very similar to that detailed in the Teachers' Notes.
The teacher should complete the ISA Explanation Sheet for each different method used in an ISA. This should be included with the outline of work suggested to students and the sample of candidates' work that is sent to the moderator.

Instructions of a general nature may be given to the candidates, but these must not be so prescriptive as to preclude candidates from making their own decisions and developing their own lines of enquiry.

Individual candidates need to collect sufficient data for producing a relevant graph or chart but may share and use data produced by other members of a class.

Candidates should carry out a fieldwork investigation related to the identification of patterns of pollution in a local area or region.

It is recommended that this investigation is put into an applied context such as the work of scientists employed locally by the Environment Agency. There may well be opportunities for candidates to work with officers in local government departments or local companies concerned with pollution controls.

They may investigate any factor that may influence local environmental pollution. Examples of this investigation might include:

- a study of variations in water quality in local streams
- an examination of variations in air pollution or the acidity of rainfall
- a survey of patterns of distribution of certain pollution-indicator organisms.

As part of their work students will seek causes for any variations and patterns found, which might include the influences of farming or industrial activity, motor vehicle exhaust substances, domestic waste and the effects of local weather and relief.

The Data Processing
For this part of the investigation candidates must work individually under direct supervision.

Each candidate must draw up **his or her own** table of results and should process the data in an appropriate way, eg charts, graphs, diagrams.

The candidates' work should be collected by the teacher at the end of the session and only returned to the candidates when they undertake the subsequent ISA.

Candidates' work must **not** be annotated with additional information, either by the teacher or the candidate, which would give them an unfair advantage during the ISA, eg the use of the terms independent / dependent variable.

GCSE Environmental Science ISA

ISA 2 – Laboratory Investigation – Teachers' Notes

Valid for submission in June 2011

This ISA relates to Section A: Environmental Issues

Area of investigation
This work should be carried out during the teaching of the section relating to:

A2.2: How can energy consumption be reduced?

Candidates should be aware that energy suppliers are obliged to encourage people to use energy more efficiently. This might include helping with the supply and costs of installation of energy-saving measures and providing advice on energy efficiency. They should know and understand that energy consumption can be reduced by methods including:

- improved efficiency of energy-consuming devices eg boilers, domestic appliances
- improved insulation eg loft and cavity wall, double glazing, curtains
- lifestyle decisions eg reduced use of central heating and air conditioning.

The practical activity devised by the teacher should enable candidates to show their ability to:

- set up an experiment to compare the insulating properties of different materials
- select information through random sampling
- demonstrate personal knowledge of working safely and show due regard for the well-being of living organisms
- show awareness of different measures of insulation efficiency eg U values, tog rating
- use data to calculate energy savings and pay-back times
- demonstrate the potential energy saving of lifestyle choices eg reduced central heating temperatures
- estimate longer-term effects of reducing energy consumption on carbon footprints and pollution.

It should also give candidates an opportunity to gain knowledge of ways in which energy and different types of insulation can be used efficiently in the home and the workplace. There may be an opportunity, in preparatory work, to liaise with local council or school staff who may be involved in sustainability programmes or energy-saving programmes.

Section 2 of the ISA will relate to the marketing of insulation products and will give candidates an opportunity to demonstrate their understanding of the need for companies to give clients accurate information to:

- identify differences in thermal properties
- relate material costs to personal selection of insulating materials
- understand how use of well-chosen materials can reduce energy consumption
- demonstrate their support for sustainable policies.

Risk assessment
It is the responsibility of the centre to ensure that a risk assessment is carried out before candidates commence any laboratory work.

The practical work
For this investigation candidates may work individually or in groups.

Some suggestions are given and, as far as possible, centres should use a task very similar to that detailed in the Teachers' Notes.
The teacher should complete the ISA Explanation Sheet for each different method used in an ISA. This should be included with the outline of work suggested to students and the sample of candidates' work that is sent to the moderator.

Instructions of a general nature may be given to the candidates, but these must not be so prescriptive as to preclude candidates from making their own decisions.

Candidates should carry out a laboratory investigation on the effectiveness of insulating materials for energy saving. These might include curtain materials, wall and loft insulation, double glazing, draught proofing, plasterboard and roof liners. They should investigate heat transfer through materials by measuring temperatures.

It is recommended that this investigation is put into an applied context such as the work of your local council or your centre's policy on energy use. There may well be opportunities for candidates to work with officers in Local Authority departments, school site managers or with local companies concerned with energy-saving schemes.

In their practical work candidates should focus on those factors which directly influence the effectiveness of a material as an insulator eg thickness, nature of material. They should also be aware that other factors may influence the choice of material as an insulator.

Candidates need to generate sufficient data to produce a table to show the results and draw a graph and / or chart to show their results.

The Data Processing
For this part of the investigation candidates must work individually under direct supervision.

Each candidate must draw up **his or her own** table of results and should process the data in an appropriate way eg charts, diagrams, graphs. They must also demonstrate the use of numerical calculations.

The candidates' work should be collected by the teacher at the end of the session and only returned to candidates when they undertake the subsequent ISA.

Candidates' work must **not** be annotated with additional information, either by the teacher or the candidate, which would give them an unfair advantage during the ISA, eg the use of the terms independent / dependent variable.

GCSE Environmental Science (44402)
ISA Explanation Sheet

to accompany each ISA
(You will need to fill in more than one of these sheets if different students have carried out different methods)

Centre Number						Year of submission

ISA Title

Name of Teacher

Independent variable	Dependent variable

Did you make any changes to the suggested method?

YES / NO

If YES give details of any changes you made to the suggested method, the equipment, chemicals etc. for this investigation.

Any other Information:

Teacher Signature:

Please attach any experimental worksheet or outline used by the candidates to carry out the investigation if available.

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