

# CONTENTS

---

FOREWORD .....	1
ENVIRONMENTAL SCIENCE .....	2
GCE Advanced Subsidiary Level .....	2
Paper 8290/01 Paper 1 .....	2
Paper 8290/02 Paper 2 .....	5
Paper 8290/03 Individual Research Report .....	11

## FOREWORD

---

This booklet contains reports written by Examiners on the work of candidates in certain papers. **Its contents are primarily for the information of the subject teachers concerned.**

# ENVIRONMENTAL SCIENCE

---

## GCE Advanced Subsidiary Level

Paper 8290/01

Paper 1

### General comments

There did not appear to be any problems with finishing the examination in the time allowed. Many candidates achieved good marks on one or two questions but few demonstrated sound knowledge of the subject across all areas of the syllabus. There was evidence that some candidates lacked sufficiently detailed knowledge, in any area of the syllabus, to enable them to answer questions at this level. Where recall of facts was all that was required, candidates with a reasonable knowledge of the subject provided adequate answers but all candidates appeared to have difficulty with questions involving interpretation of data. The data was often not referred to at all, even when the question specifically required this. Candidates seemed to be unfamiliar with application of knowledge in this way. Candidates' answers were not always relevant to the question set. Candidates should ensure that they read the questions carefully and understand what is being asked. Legibility of handwriting was a problem in one or two cases. Whilst every effort is made to interpret candidates' scripts, candidates who do not write clearly may be disadvantaged.

### Comments on specific questions

#### Question 1

- (a) The correct answer, *continental drift*, was confused with *sea-floor spreading* by some candidates.
- (b) Most candidates gave the correct responses, (i) *Pangaea* and (ii) *Gondwanaland* (Laurasia) but a few candidates seemed to be unaware of these names. Fewer candidates named *tectonic plates* correctly (iii), with *tectonic* being omitted in many cases. "Plates" is insufficiently precise.
- (c)(i) Stating that "the mantle lies beneath the Earth's crust" is not precise enough as the core could also be described in this way. Candidates should make it clear that the mantle lies between the crust and the core. Further detail of its semi-molten state was given by some candidates but its depth and particular composition, with reference to silicate rocks or iron/magnesium content were not accurately stated.
- (ii)(iii) Candidates understood that the tectonic plates are less dense than the mantle and many understood the idea of convection currents in the mantle causing movement but explanations were not always clear and the term *convection current* was seldom seen.
- (d) Many candidates simply repeated the question, stating that the continents "shared fossils and geology" but offered no further explanation. The idea of *continental fit* was often shown by diagrams but details of the position of similar mountain belts and specific fossils, such as mesosaurus, needed for further marks, were seldom shown.

#### Question 2

- (a) Some candidates did not read the question carefully, so did not realise that stone and coarse sand had been removed from the sample. Most of those who had read the question correctly had no difficulty in identifying the middle layer as *silt* and the bottom layer as *sand*.
- (b) The principle of the largest/heaviest particles settling first was generally understood.

- (c) Most candidates were able to deduce the soil compositions from the triangular diagram but a few were unaware that the sum of the percentages for each soil should be 100%. This knowledge could have provided candidates with a check on their answers, which should have been: **A** sand 50%, silt 20%, clay 30%; **B** sand 10%, silt 20%, clay 70%; **C** sand 80%, silt 10%, clay 10%.
- (d) Whilst some candidates were able to relate specific properties, such as permeability, water-holding and leaching, to the stated proportions of the different soil particles, some explanations were too vague. "Because of different amounts of sand, silt and clay" is not enough. It must be stated that high permeability is related to a high percentage of sand, for example.
- (e) There were some excellent answers, with all horizons correctly labelled but *organic*, *eluvial* and *illuvial* were confused by some candidates.

### Question 3

- (a) Many candidates missed the point that the figures given were ranges of temperature, not actual temperatures. They assumed that *less than 9°C* meant that temperatures remain lower than this rather than that they fluctuate by less than this. Consequently there were few correct responses.
- (b) Reference to the effects of proximity to the sea or to altitude were expected but not seen. Candidates seemed to have little understanding of the principles involved.
- (c)(i) There was greater understanding of the information relating to rainfall and candidates commented appropriately on the position of the wettest or driest regions.
- (ii) The idea of moist winds coming from the west was made clear by a number of candidates but few could go on to explain the consequences in terms of rainfall distribution. Some candidates appeared to have confused east and west, unfortunately, making nonsense of their answers.
- (d) Some candidates mentioned the effects of cold and warm currents but details of likely direction or the possible effects of warm and cold winds were not given.

### Question 4

- (a) The correct responses were: (i) **B**, (ii) **A**, (iii) **C** or **G**, (iv) **D**, (v) **H**, (vi) **O**.
- (b) This was generally well answered, with references to the production and use of chemical fertilisers and the effects of the internal combustion engine being common answers.

### Question 5

- (a) Many candidates did not mention the role of UV radiation in the dissociation of oxygen.
- (b) Candidates could explain that chlorine atoms/free radicals react with ozone but did not go on to explain that these were then regenerated by the reaction of  $ClO$  with an oxygen atom/free radical.
- (c) Many answers were irrelevant as they made no reference to what was shown in the diagram. Where candidates did use the diagram, observation of the information that it contained was poor. Candidates did not notice that the Antarctic (and therefore the South pole) were in the centre of the diagram.
- (d) Again, this was not well-known. Candidates should know that energy from UV radiation causes the dissociation of ozone molecules.
- (e) There were many good answers, with references to specific international agreements and protocols but some of the examples of use of CFCs were rather vague. "Ban sprays" is too imprecise. It should be made clear that *the propellants in aerosol sprays* are the problem.

### Question 6

- (a)(i) Most candidates gave the correct response of 24 hours.
- (ii) The correct response was 1461 days (i.e.  $4 \times 365.25$ ). 1460 was not accepted as candidates are expected to be more accurate at this level. A few candidates confused the Earth's revolution on its axis with rotation around the Sun, so giving incorrect answers to (i) and (ii).

- (iii) The correct value of angle  $a$ ,  $23(.5)^\circ$ , was generally known.
- (iv) The correct answer was *summer*. Candidates who had answered the earlier parts of the question correctly were usually able to give a correct response here.
- (b) Most candidates showed the Earth at the correct position and angle but a few reversed the angle of tilt.
- (c)(i) The correct answers were: **A** ultraviolet, **B** visible, **C** infra-red.
- (ii) Answers lacked explanation with many simply repeating the question.

#### Question 7

- (a) Many candidates were unable to make any point beyond the fact that carbon dioxide concentration is increasing. However, there were some excellent answers which referred to the fact that the annual peaks and troughs are relatively constant and some quoted relevant figures in support of points made.
- (b) Candidates who gave good answers referred to the seasonal effects of photosynthesis, which is greater in the northern hemisphere as there is greater land mass.
- (c) There were some good answers with appropriate sources for each gas but some were too vague, such as “industries” for nitrogen oxides.
- (d) The correct answer was *methane*. *Carbon dioxide* was a common error. Some candidates were unable to carry out the calculation but there was a good number of correct responses. The calculation was  $(0.015 \times 100) \div 1.72 = 0.87\%$ .
- (e) Many candidates missed the reference to *molecule* in the question so answers were often irrelevant in this context. The points looked for were the relative amounts of energy absorbed by the molecules or their relative longevities.

#### Question 8

- (a)(i) Definitions of *biome* were not very clear, although the general principle of a large area or ecosystem with characteristic vegetation seemed to be understood.
- (ii) The correct identifications were *desert*, *savannah*, *tundra* and *tropical rainforest*. *Tropical rainforest* was usually correctly identified but the other biomes, especially *savannah* and *tundra*, were sometimes confused.
- (iii) The correct answers were: **A** tropical rainforest, **B** tundra, **C** savannah, **D** desert. This was generally well answered, with more correct responses than (ii).
- (b)(i) Candidates were unable to give credible explanations, simply referring to the large amounts of vegetation in tropical rain forest, but with no mention of rainfall or temperatures and the effect on nutrient recycling.
- (ii) Candidates mentioned the greater availability of water but did not refer to the long periods of daylight.

#### Question 9

- (a) Many candidates gained marks for naming *omnivores* and *decomposers* but a common error was to name producers.
- (b) Most candidates understood that the snowshoe hare is a main food source for the lynx.
- (c)(i) Candidates were able to extrapolate this information from the graph. Answers in the range  $150\,000 \pm 5\,000$  were accepted.
- (ii) Candidates understood that the area occupied by the snowshoe hare population would be needed but few referred to needing to know what fraction of the total population was caught.

- (d) This was generally badly explained. Candidates indicated that both populations fluctuated but did not state the length of the cycle or that the hare maxima always preceded the lynx maxima as well as hares usually outnumbering lynx. Candidates seem unfamiliar with identifying trends when shown in this type of format.
- (e) Many candidates did not understand that the fluctuation in numbers is reflected in the numbers caught but that a fall in numbers is not because large numbers are caught.
- (f) Some candidates ignored the information provided that stated that there were no carnivores on the islands studied. Good answers included the idea that availability of food and territory would impose intra-specific competition, resulting in periodic population crashes.

#### **Question 10**

- (a) The correct responses were: (i) **B**, (ii) **C**, (iii) **A**, (iv) **D**. These were generally correctly identified.
- (b) The correct pyramid was **Z** but a number of candidates selected **Y**.
- (c) Candidates gave plausible explanations but could make points more convincingly by relating them to the shape of the pyramid.
- (d) Many candidates gave very long answers. The number of lines provided and the number of marks available should indicate the length of answer required. The weakness in many responses was that general points about developed and developing countries were made without direct reference to the data presented or comparisons of the three pyramids.

**Paper 8290/02**

**Paper 2**

#### **General comments**

Overall, candidates showed insufficient detailed knowledge to answer either section well. There was only one rubric infringement, where a candidate made an attempt to answer two options, and candidates within Centres all answered the same option, indicating that this had been specifically selected and taught. In view of this, it was disappointing that candidates did not show greater depth of knowledge of the chosen option. Many candidates lost marks because they did not read the questions carefully and so did not answer the question set. Answers must be relevant as well as factually correct. Where information and data forms part of the question, candidates should assume that this is intended to inform their answers.

#### **Comments on specific questions**

##### ***Section A***

##### **Question 1**

- (a) Candidates referred to the fact that there is a greater proportion of ocean in the southern hemisphere but were unable to explain the significance of this, beyond the observation that the ocean has a modifying effect.
- (b) Candidates referred to effect of the angle of the Sun's rays when penetrating the atmosphere but references to the high albedo of snow and ice and the use of heat to melt snow and ice were seldom seen.
- (c) Although this was not always well-expressed, candidates clearly understood the principle that ice would float, effectively insulating the water below and leaving it unfrozen.

## Question 2

- (a)(i) Most candidates understood that isobars are lines joining points at the same atmospheric pressure but some confused them with indications of the same wind speed or direction.
- (ii) Many candidates showed this correctly with wind direction from left to right and almost horizontal to the isobars, but a few simply drew an arrow perpendicular to the isobars from high to low pressure. This would not be an accurate depiction of direction.
- (iii) Candidates were aware that the wind would be strong but few referred to very strong winds being caused by a very rapid drop in pressure. As the question asked for an explanation, this detail was required for full marks to be awarded.
- (b)(i) The anticyclone should have been shown in the centre of the area of high pressure.
- (ii) Most candidates mentioned correct features of anticyclonic weather such as clear skies and lack of rain. Fewer referred to settled weather or light winds.

## Question 3

Many candidates answered this question well, making good use of the data to illustrate the terms *habitat*, *niche* and *competition*. A few candidates seemed unable to distinguish between *niche* and *habitat*. Interpretation of the data on food was better, generally, than that of vertical distribution of the three species. In particular, candidates did not recognise that the loga was relatively evenly distributed throughout the vertical space.

## Section B

### Option 1

## Question 4

- (a)(i) The unit of power is the *watt*. This was not known by a significant number of candidates.
- (ii) The unit of energy is the *joule*. This was generally well-known.
- (iii) Most candidates were able to use the correct formula,  $P = E \div t$ , to give the calculation:  $2400 = E \div (2 \times 60)$ . Hence  $E = 288\,000$  joules.
- (b) There was reference, in most responses, to water turning turbines but candidates did not make it clear that the water stored in the reservoir would be at a high level, therefore having high potential energy, or the importance of allowing the water to fall to a low level in converting this potential energy.

## Question 5

- (a)(i) Most candidates named the fossil fuels correctly as *coal*, *oil* and *natural gas*.
- (ii) Few candidates gave the correct response, which was *gas*.
- (b)(i) Most candidates gave the correct response, *fuelwood*.
- (ii) The idea of low energy content was the general correct response but one or two candidates mentioned lack of versatility as countries become more developed, a good answer.
- (iii) Most candidates gave the correct response, *oil*.
- (iv) Again, the correct response, *nuclear*, was generally given.
- (v) Some candidates did not express themselves clearly, although references to hazardous waste, storage problems and accidents, amongst issues which could have been mentioned, were made. Simply naming an incident, such as Three Mile Island or Chernobyl leaves the Examiner to do some work for the candidate. The candidate should indicate the relevance of the reference.

### Question 6

- (a) A few candidates mentioned *solar cells* but gave no details of this method of harnessing solar radiation. There were more descriptions of *solar panels* but these were not very clear. No candidate described a *solar furnace*.
- (b) The idea of renewable, non-polluting energy was understood.
- (c) Few candidates gave a coherent answer here. The need for long hours of reliable sunshine did not seem to be appreciated.

### Question 7

- (a) The source of energy is the Sun, known by most candidates.
- (b)(i) Candidates' responses concentrated on environmental problems, rather than answering the question. It was expected that there would be references to the diameter of the turbines and a site with constant high wind speed.
  - (ii) Answers here were generally relevant and candidates were able to give one or two possible objections.
  - (iii) The variability of winds was mentioned but some candidates could not suggest a second problem. Reference to the amount of land or the large number of turbines needed to generate sufficient power could have been made, for example.
- (c)(i) Details of the way in which a tidal barrage operates were not known and few marks were gained here.
  - (ii) Candidates who answered this generally mentioned a plausible environmental problem associated with barrages.

### Question 8

- (a) Quite a number of candidates appeared to know nothing about the *geothermal gradient* and were unable to answer this.
- (b) Candidates were equally unable to provide an answer to this, where reference to areas of igneous activity, high concentrations of radio isotopes or low density siliceous rock was expected.
- (c) One or two candidates were able to give some indication of the heating of water by exploiting geothermal energy but few details were given and again, in a number of cases, this was not known at all.

### Question 9

- (a) This question was not well answered. Candidates were unable to describe the formation of photochemical smog with any accuracy. Candidates introduced irrelevant material with references to the enhanced greenhouse effect and global warming as well as acid rain in some answers. Candidates must read questions carefully and resist the temptation to include material which does not answer the question set, as this will not gain marks, however factually correct.
- (b) Answers in this section were better. Candidates referred to cleaning up or reducing emissions from industrial processes, although none mentioned the methods by which this could be achieved. Most referred to reducing emissions from motor traffic and were able to mention the importance of catalytic converters and engine efficiency as well as encouraging reductions in car use.

### Option 2

### Question 10

- (a) The porous or permeable nature of the rock forming an *aquifer* was missing from explanations.
- (b)(i) The confined aquifer should have been shown between layers of impermeable rock. Candidates who were able to answer this correctly generally gained full marks for the whole of (b) but some candidates were unable to indicate any of the aquifers correctly.

- (ii) The unconfined aquifer should have been shown above the upper layer of impermeable rock.
  - (iii) The perched aquifer should have been shown above the impermeable rock and spring on the right of the diagram.
- (c)(i) Candidates interpreted the data given quite well but some omitted to make clear to which figure (10.2 or 10.3) they were referring when stating a difference. For example, if the candidate stated that there was a shorter time lag to reach the peak discharge, it must be made clear that this is after the housing development has taken place.
- (ii) This was well answered, in many cases, with relevant points about infiltration and the increase in hard surfaces commonly being made. Fewer candidates made coherent points about the obvious increase in drains shown in Fig. 10.3. A few candidates suggested that the increased use of water domestically was a factor but these candidates had not read the question carefully enough, as it referred to a situation after heavy rain so domestic waste water was not relevant.

#### Question 11

- (a)(i) Candidates seemed to know little about *cholera*, with few mentioning the correct causative agent. In addition answers did not address the way in which the bacterium would be spread by the practices mentioned in the question. Too many answers concentrated on irrelevant material about symptoms of the disease. Candidates must answer the question set and use the information provided.
- (ii) The same problems as in (i) were shown here. Some candidates were aware that *schistosomiasis* is caused by a parasite which has the snail as a secondary host but it was clear that quite a number knew little about this disease. This is disappointing as the required knowledge of these diseases is detailed in the syllabus.
- (b) Most candidates referred to water treatment and clean water supplies with few mentioning vaccination, in relation to cholera. Surprisingly few candidates mentioned killing snails as a control for schistosomiasis, in spite of the fact that they clearly knew that the snail is an essential element of the parasite's life cycle.

#### Question 12

- (a)(i) The difficulties of separating the different types of plastic was mentioned by candidates who gained a mark here. The lack of facilities for using re-cycled plastics would also have been an appropriate point. However, too many candidates gave vague responses such as "It is easier" or "It is cheaper", which would not justify a mark being given.
- (ii) Many candidates were aware that plastics are not bio-degradable, although some did not express this very clearly but none mentioned the fact that most plastics are produced from oil, a non-renewable resource.
  - (iii) Other types of waste could have included steel, textiles and vegetable matter. "Metals" is too vague, as aluminium is listed in the data provided.
- (b) Most candidates referred to the production of polluting gases in incineration but they should be able to name such a gas, oxides of nitrogen or sulphur for example, at this level. The toxic ash remaining and leaching of toxins from it could also have been mentioned.

#### Question 13

- (a)(i) The idea of minerals moving down with drainage was generally understood.
- (ii) "More porous" is not an adequate answer here. A reference to sandy soils was expected.
  - (iii) This was well answered, with references to loss of soil fertility and pollution of groundwater sources.
- (b) Candidates understood the significance of salinisation as a consequence of constant irrigation, although their toxicity to plants was not always mentioned.



#### Question 14

- (a)(i) Candidates could not state accurately that *placer deposits* are composed of heavy, metal-rich grains concentrated in sedimentary deposits.
- (ii) The idea that the gold grains are heavy and would, therefore, lag behind in the bed load was not expressed by candidates, who seemed to have little knowledge of this area of the syllabus.
- (b)(i) Lack of knowledge in this area of the syllabus meant that few candidates could define *bulk materials*.
- (ii) The materials that would have been appropriate here include clay, limestone, sand and gravel. The question specified a different use for each of the materials named. Some candidates suggested “construction” for each material. This is really too general a term – road construction or a specific building process should be named. In addition, marks would be lost where the same use was named for two or more materials. Candidates must ensure that their answers meet the stated requirements of the question.
- (iii) The question asked for problems caused by quarrying so it was disappointing that so many candidates referred to problems caused by deep mines. Candidates who provided relevant answers mentioned destruction of habitats and the visual effects of quarries but could also have referred to the effects of dust, noise and traffic caused by quarrying activities as well as the danger of abandoned quarries and the potential pollution where they are used for land-fill.

#### Question 15

- (a) There were some good answers here, with accurate definitions of *eutrophication*, clear descriptions of the way in which it is brought about and good knowledge of its effects. Some candidates seemed to think that any industrial effluent would cause eutrophication, confusing this with toxic pollutants. References to acid rain were also inappropriate but overall the subject seemed to be well understood by candidates.
- (b) Quite a number of candidates confused sewage treatment with water purification for consumption, so some parts of answers were not relevant. There was also some confusion about the roles of aerobic and anaerobic bacteria at different stages in the processing of sewage and which processes related to the sludge resulting from sedimentation and the remaining effluent. Clear, well-annotated diagrams could have helped answers here.

#### Option 3

#### Question 16

- (a) Candidates were generally able to define *species* but fewer could define *variety* as a group within a species with clearly different characteristics (genetically distinctive) from other members of the species.
- (b) This was not answered well. Candidates did not appreciate the significance of the geographical isolation that the road would bring to the populations on either side of the valley, the different conditions clearly shown on either side and the ultimate consequences of these factors. Answers did appear to use the data provided.

#### Question 17

- (a) This was well-answered with candidates understanding the various ways in which plant cover reduces soil erosion.
- (b) The idea that the crop of millet would provide less soil cover than the grass was understood.
- (c) Candidates described general methods of controlling erosion rather than ways of stabilising terraces. If candidates had used the data in Fig. 17.1, as required by the question, it should have been clear that some form of plant cover, such as grass bunds, would provide stability.

### Question 18

- (a) Candidates seemed to have little idea of the reasons for the growth of fish farming, so few marks were gained.
- (b) This area of the syllabus did not appear to be known by many candidates and few were able to make relevant suggestions of advantages and problems associated with fish farming. It is essential that candidates ensure that they are familiar with all areas of the syllabus within their chosen option in order to have a chance of achieving a good mark.

### Question 19

- (a) Candidates did not make a clear distinction between the processes of *artificial selection* and *genetic engineering*. In particular, the idea that artificial selection is cross-breeding within a species, selecting parents for desirable characteristics, was clearly not understood in many cases.
- (b) Some candidates were aware of the use of genetic engineering in producing drugs and in producing crops resistant to herbicides but many were unable to give an appropriate answer.
- (c) It is a pity that so few candidates had any real knowledge of this topic, which is of considerable current interest to governments, farmers and environmentalists. Beyond vague suggestions of disruption within the environment, there were few correct answers.

### Question 20

- (a)(i) It was necessary for candidates to think beyond fuelwood and timber production to suggest four forest products. Some were able to do this, mentioning food products for man and animals and materials for medicines, amongst others.
- (ii) Candidates answered this better and were able to make correct suggestions for deforestation.
- (b) Candidates must use data provided when answering questions if their answers are to be relevant, applying this to the problem set. Questions do not always rely on simple factual recall. A coherent response would have included reference to the city population buying wood from rural people putting increased demand on supplies close to the city. This would result in wood being collected from further away and these areas gradually being stripped of trees as demand increases. Few answers included any of these points.
- (c)(i) Reference to soil erosion and species loss were good answers seen in many responses.
- (ii) Candidates generally gave good answers related to aspects of grassland maintenance such as re-sowing and avoiding overgrazing.

### Question 21

- (a) There were some good answers, elaborating on the effects of disrupting ecosystems, economic effects especially related to tourism and more general ethical reasons. There is a tendency in weaker candidates to bring in references to global warming and other environmental concerns which have no real relevance to the question set.
- (b) Again, a number of candidates did not address the question set. They concentrated on reasons to protect the African elephant, which were more relevant to the previous sub-section of the question, rather than the problems and difficulties involved in protecting this species. There were some good answers but generally candidates did not seem to be well-informed about international trade bans on ivory or moves by some countries to seek management policies rather than hunting bans where elephant overpopulation in areas was a problem.

### **General comments**

Even with a small entry it was pleasing that there was a wide variety of topics incorporating water quality, ecological studies, energy supply and conservation, urban pollution and river pollution. It is commendable that candidates submitted reports of a higher standard. Candidates were clearly conversant with the background to their research themes and most reports revealed a good input of primary investigation rather than relying upon secondary information.

Although the reports were generally of a high standard and showed high standards of knowledge, research and presentation, many contained a great deal of very general background information. It is still important to remember that with a recommended length of between 3000 and 4000 words candidates need to be succinct and follow the advice within both the syllabus and previous reports.

### **Comments on specific skills**

As in previous years, this section of the report addresses performances within skills C1, C2 and C3.

#### **Skill C1**

This section did not always meet the standards of previous examinations. For many, the main weakness lay in the absence of a clear hypothesis or investigative question. In nearly half the submissions the hypothesis or investigation title was consumed within a very lengthy introduction, which was more concerned with the background to the study. To provide a hypothesis or question at the outset gives the report a clear focus which can then receive elaboration. Examiners suggest that the introduction received no more than 750 words within a 4000-word report.

Although questionnaires once again proved to be a popular field technique it was good to see the use of laboratory research and river pollution analysis. Although it is perfectly permissible for candidates to use internet data within their research, it must be stressed that this should not replace primary data collection and Centres should advise their candidates against copying vast quantities of internet text. Some candidates have even resorted to the direct copying of internet text and highlighting relevant sections; this is secondary information and should be supportive of the data and explanations in the report. Additionally such sources should be credited in the bibliography.

#### **Skill C2**

This skill yielded high marks as most candidates presented some data, which in the main was derived from primary sources. Information was generally presented in a clear and relevant form and generally related to primary data. The most popular techniques used to present data were tables, pie charts and bar graphs.

It is disappointing that some candidates avoid the use of statistical techniques to verify their data; particularly where some form of sampling has been carried out. Simple tests such as Chi-squared for observed and expected frequencies or Spearman/Product Moment Tests for ranked data should be within the capabilities of all candidates at this level. Such tests could be used within the concluding sections of the report where some basis for evaluating the research data is needed.

However, it is easy to be overcritical, in the main skill C2 proved to be the strength of the majority of candidates; the use of a statistical test would be a valid refinement.

#### **Skill C3**

This proved to be the weaker part of many reports. The skills associated with the environmental principles (c, d and e) in the research, were generally well covered; parts 'a and b' of Skill C were less well covered. Candidates should be encouraged to question the reliability of their own data whether it is through their methods, apparatus or sources of information. As stated in the syllabus such sources of error should be explained. Secondly where limitations are recognised, modifications must be suggested. Skills C3 (a and b) are easier to manage if the report contains a clear introductory and method section.

## **Conclusion**

It was most pleasing that the candidates entered for this November session took on the true spirit of the environmental science syllabus and opted for issues which proved worthy of research. To the credit of their Teachers, nearly all candidates showed the benefits of the teaching and instructions they had received, through both the content and structure of their reports.

It is important that the guidelines in the syllabus are closely followed and all Teachers and candidates should refer very closely to the section titled 'Coursework': The Research Report: on page 29 of the 2002 syllabus. The project should deal with issues or an issue on a small or local scale and lend itself to field and laboratory research. Once primary data has been collected, it should be collated and a variety of statistical techniques utilised to present the information. Whilst secondary information will provide useful background to the study it should not be sole focus of the study.

Finally to reiterate a point made previously, candidates might like to adopt the following model and wordage for the presentation of their work.

- An introduction with a clearly stated hypothesis (approximately 750 words).
- An outline of the investigative methods to be used; these should be justified (300-400 words).
- A presentation of results fully described and explained (1500 to 2000 words).
- A conclusion/evaluation which: draws together the results; assesses the level of agreement with the central hypothesis; and evaluates both the effectiveness of the investigation and the environmental implications of the topic. This section could also be used to address Skill 3 (parts a and b) (approximately 750 words).