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# A-LEVEL

# ENVIRONMENTAL SCIENCE

7447/1: Paper 1  
Report on the Examination

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## General

The majority of students attempted all the questions on the paper, including those questions with a mathematical component.

The higher mark questions (9 marks) were not, on the whole, well answered. Students often gave imprecise and vague answers. The content of the answers given by students did not really answer the question set and was only of marginal relevance most of the time. Students often spent significant time and effort including introductory material but this gained them few marks. For those questions that had a mathematical component, students should be encouraged to 'show their working' when instructed to. A number of students gained at least one mark by doing this, even though their final answer was incorrect.

A few students gave extended answers to questions and often used the space provided for question 11 at the end of the examination paper. Students should be encouraged at all times to make use of additional pages to complete their answers and not 'fit' the rest of their answer in the space around other questions and embed them in the middle of other answers on the paper.

### Question 01

Almost three-quarters of the students gained three or more marks. The most common error observed was mixing up the answers to the first two descriptions concerning extrusive and intrusive igneous rocks. The last three descriptions were answered correctly by most students.

### Question 02

#### 02.1

The two-thirds of students who carefully analysed the data in the table realised that the main difference between the four soil samples, which would influence the amount of water needed by irrigation, was the low sand content. A number of students seem to think that pH was important.

#### 02.2

Almost half of the students answered this question correctly, but a number failed to mention the 'compaction' that would be caused by the use of heavy machinery mentioned in the stem of the question.

#### 02.3

The majority of students achieved the first marking point and a significant number went on to describe the reduction in raindrop impact and wind velocity, with just under half of students achieving full marks. The increased water infiltration mark was less frequently seen.

#### 02.4

A significant number of students were correct. Careless mistakes were made when observing the 'lines' drawn on the soil triangle. Students who did not achieve a mark for this question usually had incorrectly drawn the 52% sand line at 48% on the triangle.

**02.5**

Around 7% of students achieved full marks on this question with the majority gaining one or two marks. Students gave the impression that they had carried out a method to determine the % organic matter content of soil but their answers lacked detail on key points that were required in order to merit three marks. Often weighing the dry sample of soil or weighing to constant mass after burning were missed out. The temperature given for burning the soil was on a number of occasions incorrect. An answer frequently seen was - 'work out the difference in weight and calculate a %'. How the percentage should have been calculated was not given. Answers involving the use of Tüllgren funnels, soil sieves and adding water were seen.

**02.6**

Around 18% of students achieved two marks. Answers describing reduced leaching of nutrients and reduced heavy metal solubility were frequently given, as were the action of decomposers and detritivores. A significant number of students misunderstood the question and gave answers relating to increased plant survival due to enzyme activity in roots as a result of an increase in pH.

**Question 03****03.1**

This question was answered well with a significant number of students gaining full marks. A minority gained one mark, usually for identifying the correct values from the table that needed to be used in the rest of the calculation.

**03.2**

Over half of the students achieved two marks. Some students, having selected the correct values, then appeared to struggle as to 'what to do next' with them in order to arrive at an answer. A number of students calculated 70% of 1890 instead of 30%.

**03.3**

This was a well answered question with a significant number of students gaining the mark. Ammonification and decomposition were widely seen as were Rhizobium and Azotobacter.

**03.4**

This question was not answered well. Approximately 60% of students only achieved between one and three marks out of a possible nine. A large amount of students' answers were taken up with overly long introductions and conclusions, without covering a range of strategies to manage the carbon cycle. A significant number of students mentioned deforestation, afforestation and recycling without going into detail. Students that gave a wide range of management strategies and explanations rather than an extended list achieved higher marks. A number of common errors were regularly seen, such as catalytic converters reducing CO<sub>2</sub> emissions and a reduction in CO<sub>2</sub> emissions reducing ozone depletion.

**Question 04****04.1**

Over a quarter of students achieved two marks with almost half failing to gain any marks. Students gave answers that were in fact describing *enhanced gas recovery* and not hydraulic fracturing. The use of water or CO<sub>2</sub> was described but without the idea of it being under pressure, so was not creditworthy. Some students appeared to have not studied this part of the specification and therefore their answers were, at best, an educated guess.

**04.2**

More effective quality answers were seen for this question than those given for 04.1. Avoiding aquifers, seismic monitoring and geologically stable areas were common answers. Some students appeared to become side-tracked by global climate change and gave non-specific answers. Around a third of students gained two or three marks.

**Question 05****05.1**

Half of students achieved the first marking point, correctly understanding the reason why sterilisation was carried out in this context. Some students thought that sterilisation was done in order to remove 'other chemical contaminants'. Effective answers were seen and a number of students, around 30%, achieved the last marking point of understanding how the measurement of the bacterial population would be affected by the presence of other bacteria.

**05.2**

Two marks were available for this question and the one-fifth of students that achieved one mark had 'shown their working' and were credited for an earlier correct calculation, even though their final answer was incorrect. Common errors were incorrect readings of the graph, incorrect subtraction and dividing by the bacterial population figure for day 49 instead of day 0. Around a third of the students achieved full marks.

**05.3**

Few students answered this question correctly. Common incorrect answers seen were 95%, 99.5%, 5% and the wrong symbol; > instead of <.

**05.4**

Around 54% of students achieved two or three marks. Low temperatures and anaerobic conditions were common answers, as well as large oil slicks.

**05.5**

A number of students appeared not to understand how a chemical dispersant works and poor scientific expression was used by those students that did know. For example, the word 'emulsify' was very rarely seen and instead, 'oil could be split into manageable chunks' or similar words were used. Some students thought that dispersants 'absorb' oil and that dispersants 'kill harmful toxins'. Approximately 27% of students achieved full marks.

**Question 06****06.1**

Only a minority students gave correct answers. Many students did not make reference to sulfide ores or rocks and just said there would be acid leachate. A number of students thought that water and limestone would give a low pH. A significant number of answers just said 'metals make drainage water acidic'.

**06.2**

Approximately 19% of students achieved three marks. Common answers seen were standardisation of the net used, effort of substrate disturbance and comparable sampling sites. Students that went into detail on any of these points did not gain further marks as, for example, 'same number of kicks, same force of kicks, same person doing the kicking to ensure same force' are all the same marking point.

**06.3**

Students that had studied this part of the specification and could recall the key features of species used in a biotic index achieved full marks. Other students that focused on one particular point, such as sensitivity, scored less well.

**06.4**

This question was answered well, with the vast majority of students achieving one or two marks. Students understood the concepts of dilution and dispersion, which were common answers given.

**Question 07****07.1**

A large majority of the students achieved one or two marks for this question. The idea of Argo floats being less labour intensive was a common answer as well as Argo floats collect data over a more extensive area. Students that gave answers such as 'there are more Argo floats' or 'they are more widely dispersed' without the idea of producing more data or larger data sets were not credited.

**07.2**

Around a third of students gave a correct answer. Common errors were not using the trend line as instructed and dividing by six years instead of seven.

**07.3**

Just under half of students achieved full marks. Common answers, given by some students, such as 'increasing temperature', 'global warming' and 'melting land ice' gained two marks. Reduced salinity and reduced sinking were seen less often. Irrelevant points related to thermal expansion of seawater, sea level rise, as well as the El Niño effect were seen all too frequently.

**07.4**

Very few students achieved level 3 marks of seven or above. Again, similar to question 03.4, many of the answers were taken up with overly long introductions, conclusions and writing the equivalent of an essay on global climate change. Very few students picked out those points that related to the question and explained concisely how they made a prediction in the flow of the North Atlantic Conveyor difficult. A few students also gave substantial descriptions of the El Niño effect and some, from their answers, thought that the North Atlantic Conveyor was in the South Pacific Ocean off the coast of Australia.

**Question 08****08.1**

A significant number of students failed to achieve a mark on this question and very few achieved two marks. In a number of cases, careless mistakes were made by not selecting the correct tidal range of 10m from the map to use in the equation. Those students that did select 10m then failed to use  $h^2$  or  $10^2$ . Of those students that did correctly use  $10^2$ , a number appeared to struggle multiplying powers with the same base. A large number of students also failed to correctly convert Joules into Watts, dividing by the incorrect number of seconds, i.e. they did not divide by  $3 \times 60 \times 60 = 10800$ .

**08.2**

More than half of the students gave the correct answer. A few failed to round up their answer to 27%, which the rest of the data in the table indicated they should do.

**08.3**

Most students made a good attempt at this question, achieving one or two marks. A number struggled to express in scientific terms the reasons for the higher energy output from the tidal barrage, although their correct understanding was credited.

**08.4**

Around 40% of students gained 3 or more marks. Many students correctly described the method they would use to measure light intensity and turbidity but failed to describe how they would obtain the flow rate data. Vague answers were given with respect to standardisation, such as 'repeat the experiment' or 'carry out a statistical test'. A few students appeared not to have carried out the sampling technique skills of measuring abiotic factors of light intensity and turbidity, although it is a required element of the course.

**Question 09**

Students appeared, from their answers, to either know a great deal about how double and triple-glazed windows help to reduce heat loss or hardly anything at all. As a consequence, students either scored highly, four or five marks, or very little - zero or one.

**09.1**

Approximately 60% of students selected the correct answer.

**09.2**

Around a quarter of the students selected the correct answer. Students found this question more demanding as the correct total thickness figure had to be selected from the graph and then a simple calculation of subtracting the thickness of two panes of glass from that figure.

**09.3**

Just under a third of students gave excellent answers in terms of reduced conduction and convection. Other students gave answers in vague terms of 'it would reduce heat loss' or 'there would be less heat transferred' and others expressed their answers in terms of 'better insulated'. A number of students gave answers relating to larger windows on the south side of a building and smaller windows on the north side. These answers are related more to window placement rather than window design and the idea of window size is only correct in relation to the fact that walls lose less heat than windows.

**Question 10****10.1**

Very few students gained marks three marks, usually for wind direction, rainfall washing out Cs-137 out of the atmosphere and highest levels being in upland areas of GB. Despite a map locating Chernobyl, a few students mentioned ocean currents bringing Cs-137 to GB in a week and too many students described areas with higher Cs-137 levels as being '*more grassy, less urbanised*'. A minority of students didn't achieve a mark.

**10.2**

Less than 1% of students achieved full marks on this question. A few students described well the sampling techniques and the standardisation involved and not infrequently gained three marks. The determination of the Cs-137 activity in grass samples was less well described and there were quite a few students who thought that controlling external temperatures was necessary as this would affect the decay rate of Cs-137. Around a quarter students achieved three or more marks.

**10.3**

Almost three-quarters of the students gave the correct answer. Some students did not know how to calculate the activity level of Cs-137 that would be present in 2076 and divided the activity level of Cs-137 by its half-life of 30 years. One or two answers gave a much higher figure in 2076 than in 1986.

**10.4**

Just under half of students achieved one mark. A number of students gave the answer of workers in the nuclear power industry which is incorrect.

**Question 11**

A range in quality of answers were seen across 11.1 and 11.2, with the around 93% of students choosing essay option 11.2. It was encouraging to see that some students took time to plan their answers before starting. Students needed to think very carefully about the approach that needed to be taken in evaluating the environmental impacts of solid waste disposal in 11.1 and renewable

sources of energy and fossil fuels in 11.2. Too many essays were of the ‘write everything I know about the subject’ approach, as a consequence essays contained material that was irrelevant or only of marginal relevance when considering the emphasis of the question. Often students that adopted this approach filled copious amounts of paper which didn’t necessarily gain them many extra marks, if at all. Students should be encouraged to take a more focused approach in the planning and writing of their essays.

### **11.1**

Students that scored well gave a balanced account of the positives and negatives of different methods of waste disposal and included the necessary detail required. Too many students made points that were superficial, for example, ‘toxic leachate caused environmental impacts but it could be collected’. The detail of the impacts on local watercourses, as well as the use of clay and polymer liners and collection methods, was lacking. Few students discussed the treatment of specialised industrial and radioactive waste. Essays containing detailed description of the treatment of sewage effluent were also seen which was irrelevant. Around 10% of students achieved level 5 for this question.

### **11.2**

In too many cases, the answers turned into essays about global climate change and the focus of the question was lost. Again, students that scored highly gave a balanced account, covering both fossil fuels and renewable sources of energy and evaluated the impacts of both. Essays that only included renewables with a cursory mention of fossil fuels were frequently seen. Irrelevant or marginally relevant material was often included, especially with respect to intermittency, predictability and the cost of renewable forms of energy. In too many cases nuclear energy was discussed in detail, with students thinking it was either a renewable form of energy or could be placed in the fossil fuel category. Only around 2% of students achieved level 5 for this question.

### **Use of statistics**

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on how students have performed for each question.

### **Mark Ranges and Award of Grades**

Grade boundaries and cumulative percentage grades are available on the [Results Statistics](#) page of the AQA Website.