# A-LEVEL
# ENVIRONMENTAL SCIENCE

7447/1 Paper 1
Report on the Examination

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The paper was well attempted by the majority of students and it was clear that centres had made good use of both training materials and the examiner's report from last year. With an increase in the number of students sitting this paper, it was good to see an increase in the paper mean and the range of marks achieved. On the whole, the students performed better on this paper than on Paper 2. They found questions, particularly those requiring explanations or extended writing, accessible. It was also pleasing to see many more students attempting and scoring on questions requiring mathematical skills and data processing. It was evident that students were familiar with environmental terminology, however cases of poor expression limited the performance of some. This was particularly evident in short answer questions. There is also an opportunity for students to improve their understanding of the different command words. However, the structure in the paper and greater framing of questions eg, 'explain one' or 'give two advantages' continued to help students provide greater focus in comparison to previous series.

As in 2022, the practical questions were well answered, particularly those requiring study, design or identification of variables. It was good to see that students applied their understanding to specific situations. Generally, the mathematical components in the paper were well attempted. Students were generally familiar with percentage change but found questions requiring a number of stages, eg reading a graph and performing a calculation (05.4 and 07.2) or calculating mass (09.1) more of a challenge. It was encouraging to see students showing stages of their working in the space provided, which helped some collect marks for an error carried forward.

Levels of response questions discriminated well on the paper and the increased mean score on these items suggests effective preparation by centres and accessible questions. Despite the improvement there were still many cases of answers lacking direct focus, therefore we would encourage centres to help students determine key terms in such questions. We encourage students to write answers with both range and depth to achieve the higher levels and ensure that command words are addressed. There was evidence of this in 10.3 where the top scoring students effectively evaluated their response.

Timing is always critical on this paper. It was evident that some students did not manage their time. Students are encouraged to attempt higher tariff questions preferentially so that they maximise their chances of accumulating marks.

Considering the challenges faced by centres in recent years, it was good to see that student performance on this paper improved. This reflects the hard work centres undertake to prepare their students.

**Question 01**

01.1
Many students scored well on this question with 62% of students gaining full marks. Common errors included the confusion of the uptake of phosphorous with erosion. More understood the process of decomposition or decay and many scored the marks for erosion and mountain building.

01.2
This question was not that well answered with only 41% of students scoring 1 mark. Many did not read the word sustainable and therefore referred to blasting rocks or adding normal phosphorous fertiliser. Those that understood gave correct common answers like organic fertiliser or adding DOM.

**Question 02.1**

This was generally well answered with 46% of students scoring 2 marks. Many scored seismic surveys for the first part but fewer understood that gravimetry was the answer to part three. The definition of resistivity was either confused or unknown. Students needed to do more than just state that it involved the resistance of rocks without explaining or linking to electrical current.

**Question 02.2**

This was a generally well answered question, with 80% of students scoring 1 mark, although the quality of expression affected students' ability to access full marks. Students should be encouraged to be specific – eg, trial drilling gives information on ore quality or purity rather than just information on the rock. Common answers for drones included low labour intensity, large aerial coverage in a short period of time or reduction in a named environmental impact.

**Question 02.3**

This question was well attempted and there was clear evidence of good understanding. However, many students did not always explain how the method proposed led to a reduction in impact. For example, the use of baffle mounds was a relevant method to reduce noise pollution. However, what baffle mounds do to reduce the noise pollution – they absorb or deflect the noise –was not explained. Therefore, the emphasis was both on the method and an explanation of the solution. The challenge to many was the need to complete this five times to gain the marks. Students should be advised to comment explicitly on how or why in an explanation question. There were some students who mixed the pollution types and the reduction methods thereby limiting their scoring. Some also referred to habitat loss in the context of pre-mining, but the question focused on an operational mine. With a mean mark of 2.82, 59% of students scored 3 out of the 5 marks available.

**Question 03.1**

Many students understood that the correct answer was sandy clay (89% were correct). A few incorrect answers confused sandy clay with clay or clay loam. This reflects clear practice at reading a soil triangle.

**Question 03.2**

Many students (93%) scored 1 mark for identifying that soil sample B had the highest sand/ lowest clay content. However, the second mark for larger pore sizes or greatest porosity was only achieved by 31% of students. Many just repeated the question that more sand had greater permeability, without addressing why – no credit is given for what is written in the question. Students needed to refer to the size of pores, the critical factor in this explanation.

**Question 03.3**

This question produced a wide range of responses, with 72% scoring 1 mark but only 12% scoring 4. It was clear that students confused the concept of texture with other soil characteristics, such as structure or water retention. Some answers were self-limiting by talking about structure rather than texture, or not linking clearly to named texture types (despite showing some understanding). Those that did understand the question gave a generic response, for example, that clay had higher levels of nutrients than sandy soils, which was only worth 1 mark. A common development to this was the

ability of the soil to retain water. Fewer students understood (or wrote about) the mechanism which led to a change in nutrients eg leaching. A few students understood that the increased water in clay soils helped with cation exchange. However, there was a lot of confusion here and many struggled to understand that the water retaining properties of clay soils helped with nutrient access. Good answers mentioned clays had high nutrient level due to adsorption from their negative charge. Some answers showed a lack of understanding about where the nutrients actually come from, often stating that they came from rain. Overall it is clear that this is a challenging concept. However, centres could help students by linking the soil properties to nutrient retention and helping explain that different properties working together can lead to higher or lower nutrient levels (ie it is not just dominated by one factor).

**Question 03.4**

79% of students gained at least 1 mark on this percentage calculation. The most common mistake was incorrect rounding – eg to 2.8 rather than 2.9.

**Question 03.5**

Only 29% of students scored the mark on this sieving technique question. The most common correct answer was soil particles stuck on the mesh or sieve. We did not allow references to rigour in shaking or loss due to soil falling out of the sieve due to human error. Some students focused on the soil properties rather than the method which was limiting. Some good answers understood that fine soil particles could be lost as dust between the sieves.

**Question 04.1**

This question discriminated well, creating a mean of 2.6 (4). There was a divide between the students who got 2 marks for just describing two trends and those who attempted to explain these trends. Some students repeated their trend in both sections eg forest soil had lowest rate of loss and bare or farmed soil had higher rates of loss – we did not allow this mirrored statement. The most common two trends identified were increase in gradient or increase in sediment collected, and trends describing the difference in rate of rise. Common explanations included interception from forests reducing erosion rates or increased gravitational potential leading to more runoff at higher gradients.

**Question 04.2**

There was a variable quality of answers on this practically orientated question. Many students (53%) could name two appropriate variables for 2 marks. However, fewer could access the marks for explaining the need to control (only 12% scoring full marks) with many answers simply reiterating the variable eg wind speed, there is a need to have the same wind speed because different wind speeds affect erosion – answers needed to say why. A significant number of answers did not use the information in the graphs and gave ‘slope gradient’ as a variable that had to be controlled. Good answers commented on the variability of rainfall leading to differences in rain splash or runoff, or commented on soil texture and the differences in permeability leading to differences in runoff rates.

**Question 04.3**

This was a well answered question with over 84% gaining some credit. Students’ main limitation was giving an outline, ie, developing how the factor (increased sedimentation or turbidity) led to an

impact on the river. Common answers included increased turbidity reducing light and therefore photosynthesis, or an increase in soil nutrients leading to increased eutrophication.

**Question 05.1**

This was a well answered question, with many students (42%) scoring full marks. The most common errors were the incorrect selection or addition of data however, marks were still available for error carried forward (ecf). It was good to see students set out their work in stages, which meant they could receive marks for their working.

**Question 05.2**

This question produced a range of responses with only 30% of students achieving a mark of 3 or more. Different approaches to the question included students answering in the context of the issues with HEP schemes, with others focusing more explicitly on low head. Those who confused low head turbines with wind turbines scored no credit. Many focused their answers entirely on the human aspect (community or situational) rather than the technological suitability, referring to the need for less maintenance, or reduced infrastructural requirements. Most common answers included not needing to flood or build a dam, or the reduced environmental impact (although this needed to be named). Some good answers understood the difference in drop height, or the specific use of turbines which could accommodate low flow or turbid conditions. While there was good understanding shown there was a need for comparisons to be explicit.

**Question 05.3**

Although a 1-mark item this was not so well answered, with only 43% achieving the mark. Many students overlooked the question which stated the site was suitable. Therefore, comments on low flow or a lack of water supply were not relevant. Some just stated public objection without specifying what was the basis of the objection. Many correct answers opted for land use conflict with existing land owners, or issues with protection orders/ designations.

**Question 05.4**

This question required students to complete a calculation using the graph and then to determine output (kW). There were mixed responses, but it was good to see that 61% of students achieved at least 1 mark for the initial calculation. Many students set their answer out in stages allowing them to pick up a mark for a valid calculation even without the correct final answer. Only 30% of students correctly read the efficiency value from the graph. Fewer students (10%) knew how to use the efficiency value (eg efficiency value / 86 x 100) to complete the third stage of the mark scheme and calculate the output value.

**Question 05.5**

There was a wide range of answers and good understanding was shown with 92% of students scoring at least some credit. Popular answers included the flooding by the reservoir creating a habitat change or loss and the blocking of migratory routes for fish species. Some students were self-limiting by giving two points about microclimate eg impact on precipitation and then impact on wind, (for the same marking point) when only one was available. This was an outline question, so this required more than a statement (ie <u>how</u> the named factor impacted the local environment).

**Question 06.1**

Variation in interpretation of the question led to variable responses, with only 18% scoring 2 marks. Many noticed that nuclear was consistent or reliable for the advantage. Fewer commented that it could not respond to changes in demand for the disadvantage. Students did not get credit for commenting on the environmental impact of nuclear, which is not relevant to meeting demand. Students need to specifically answer the question ie 'Use Figure 5 to suggest …'.

**Question 06.2**

Again, this question led to a variety of responses, with some not understanding the concept of pumped storage. Consequently 65% of students scored only 1 mark. Those that focused on how HEP met changes in demand accessed the marks. Good answers focused on the transfer of water back to the (upper) reservoir in periods of low demand and then releasing it when needed. Strong students referred to peak shaving / gravitational potential energy to explain the element of storage.

**Question 07.1**

This question challenged many students with only 45% getting the mark. The most common mistake was adding the two groundwater (17) values from the table to get 34 – not recognising they were linked.

**Question 07.2**

The residence time equation was generally well attempted, with 82% of students scoring at least 1 mark. Those that selected the correct numbers often got to 2 marks with an appropriate calculation. The main difficulty was translating 0.03 years into days (requiring the multiplication of 0.03 by 365). Some used the incorrect values but could apply the equation and still score marks through error carried forward. It was pleasing to see calculations set out in stages.

**Question 07.3**

86% of students scored 1 mark, showing clear understanding. Students commonly noted that increased interception led to less groundwater store or plant roots absorbing water (uptake), resulting in the reduction. Some were confused that trees would allow more infiltration and therefore more water would get into soil. Other students were not clear on what the trees did with water and gave vague phrases such as 'trees used water'.

**Question 08.1**

Two marks available were for the ability to read the graph and to calculate the time. Many students (54%) could do this. Some, however did only half of the requirement, most commonly reading the graph correctly but incorrectly translating this to hours and minutes. Often students who made this mistake divided the number of minutes by 60 and then used this decimal to incorrectly work out time eg 8.3 hours = 8 hours 33 rather than 8 hours 20. Some did get credit for incorrectly reading the graph but translating correctly.

**Question 08.2**

An impressive range of answers meant students scored well on this (58% scored full marks). Common answers included stress, insomnia, heart disease or high blood pressure. Some students

did not account for prolonged exposure to noise therefore giving conditions related to sudden noise exposure.

**Question 08.3**

This question discriminated well and 60% of students scored up to 3 marks. Many scored credit for reference to systematic sampling and an appropriate interval (eg 50m), or for a transect length of 500m or to the residents. Other popular answers included the use of calibrated devices or the same height of measurements taken above ground. Some students were not clear on the specific details eg taking repeated readings but not linking to calculating the mean, or same weather conditions without specifying wind or precipitation. Some included information on statistical tests, which was not relevant for the data collection aspect of this study.

**Question 08.4**

Many students understood the methods to reduce noise, eg double-glazed windows, but did not include an outline of how this reduction occurs in their answer, hence only 41% scored a mark. The students had to show how the given method reduced noise pollution. Correct answers would refer to noise being deflected, absorbed or a reduction in transmission of noise. In an outline, students need to give more than just the factor doing the reducing – they have to say how.

**Question 09.1**

Many students had some idea of the calculation of mass and volume and therefore scored some credit. What confused many was the translation into $m^3$ and therefore many answers were correctly calculated but gave the wrong order of value (still scoring marks for ecf). It was good to see students' understanding of significant figures with many giving appropriate answers. Despite being a challenging question, it was also good to see students having a go with many picking up marks for showing their working.

**Question 09.2**

Many students scored marks for recognising that satellite data can be collected (in greater amounts) more quickly and covering a larger area. Some did not focus on the data element of the question and referred to pollution associated with aircraft or manpower. Many students however gained some credit (80%).

**Question 09.3**

The majority of students (85%) gained some credit with many recognising the impact of reduced light levels reducing photosynthesis. Some answers were limited by not specifically mentioning photosynthesis – but these were in the minority. Students found the second mark less easy to obtain (only 27% scoring full marks). Common correct answers included toxicity of the oil, or the reduction in dissolved oxygen reducing respiration. But again, quality of expression and use of scientific terminology limited some students here.

**Question 09.4**

There were many good answers with 65% scoring at least 2 marks. Some errors included saying the same point twice eg better navigation and better GPS. Common answers included double hulls, better navigation and twin engines.

**Question 10.1**

The impact of El Niño on ocean currents was not well understood with only 38% of students scoring more than 1 mark (4). Common errors included describing the graph. Some were confused by suggesting anchovies liked warm water, or that anchovies migrated west across the Pacific. Some were not clear on how the currents changed. Others did not focus on currents and spoke about changes on land, which did not receive credit. For those who understood the process of El Niño they often gained near or full marks, hence the bi-polar nature of answers.

**Question 10.2**

Many students scored at least 1 mark (61%). Common correct answers included increased flooding and increased temperature. Many gave the combination of increased flooding and reduced temperature, or more floods and more droughts thereby contradicting themselves. Some students said increased rainfall and then increased flooding, which were the same marking point.

**Question 10.3**

This question was well attempted with a mean mark of 4.97 (9). Many students recognised methods to reduce global climate change. Common answers included the use of renewables, international agreements and the use of afforestation for sequestration. Range and depth of understanding were differentiators. Students with a wider range of methods to reduce the emission of different greenhouse gases tended to score better than those with fewer. Many answers went into depth about CFCs, ozone depletion and the success of the Montreal protocol, but some gave little or no reference to how this reduced climate change. However, the main discriminator here was the command evaluation. Students needed to evaluate the success or failure of the solutions to reducing climate change. Some answers gave general comments such as 'this was successful in reducing climate change' with no justification. Many focused on why these methods would bring success but excellent answers could also comment on why they had not worked.

**Question 11.1**

This question was far more popular (1096 students) and produced greater focus than those who took 11.2. 8% of students scored L5 responses compared to 3% on 11.2. The mean mark on this question was 12.5 compared to 10.9 on 11.2.

Students generally structured their answer around the different properties, although some opted to just use different types of pollutant. The key discriminator was how students focused on the question. Many spent a lot of space simply describing or explaining the impacts of the pollutant on the environment. The better answers achieving L4 and 5 linked how this understanding helped reduce the impact on the environment.

Too many students gave good specific detail on pollutants only to say 'this knowledge can be used to reduce the impact on the environment' without saying how. Many answers did not name specific pollutants (despite showing knowledge about their properties), therefore these could not achieve higher level marks as impacts and methods to reduce the impacts could only be described in a very general way. L5 answers generally had range of pollutants or properties and clear discussion of the relative benefits of this knowledge and understanding for methods to reduce impact.

The key to this question was focusing on the use of knowledge of properties to explain how these properties cause impacts, and then to link the methods to those properties.

**Question 11.2**

Many of the answers were not focused on the properties of energy but instead the different types of energy, eg, renewables or non-renewables. Those that did this and focused on the impact on the environment and methods to reduce impact could still gain credit. Some implicitly spoke about properties without explicitly mentioning them. Good answers tended to have an explicit focus on the properties. They could explain why understanding them helped reduce impact on the environment, but could also discuss the methods, by exploring some of their negatives as well. This question was less popular than 11.1, with only 546 responses.

**Mark Ranges and Award of Grades**

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.