EXAMINERS' REPORTS

LEVEL 3 DIPLOMA/EXTENDED DIPLOMA IN ENVIRONMENTAL SCIENCE

SUMMER 2019

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https://www.wjecservices.co.uk/MarkToUMS/default.aspx?l=en

Online Results Analysis

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Annual Statistical Report

The annual Statistical Report (issued in the second half of the Autumn Term) gives overall outcomes of all examinations administered by WJEC.

ENVIRONMENTAL SCIENCE

Level 3 Diploma / Extended Diploma

Summer 2019

UNIT 1

General Comments

Nine centres entered candidates for unit 1 in summer 2019.

Administrative work was mostly correctly submitted, with authentication sheets signed by the candidates.

Most of the work was very well annotated where assessment criteria were clearly referenced in the margin.

There was, again this year, some instances where some candidate work was not annotated – this made it difficult for the moderators to see where marks were awarded and therefore difficult to agree with the centre's assessment decisions.

It was good practice to number pages and provide an index. This meant that it was easy to locate evidence for each assessment criterion.

Comments on individual questions/sections

Activity 1

To obtain top band marks in activity 1, both energy devices tested should show evidence of band 3 standard. If this is not the case then a 'best fit' mark should apply.

Task 1
AC4.1: The planning section of the experiment was generally carried out very well with evidence of candidates setting achievable time scales to carry out their plan.

Task 2
AC4.2: This AC was generally well done by candidates.

AC4.3: To achieve the top band in this criterion, candidates should note the precision of the apparatus used (e.g. in the apparatus list the ammeter has a precision of ±0.001 A). There was much better evidence of candidates obtaining sufficient repeated results.

AC4.4: This AC was generally done well by all candidates. They collected the data that was stated in the plan.

Task 3
AC4.5: This AC was generally addressed well. However, candidates need to show the equations that were used, and how these equations are used. To achieve the top band for this criterion, I would expect the correct use of significant figures in line with the precision of their instruments.

AC4.6: Candidates produced very good graphs and most drew Sankey diagrams to scale for their devices. However, there was still examples of candidates not correctly converting their numbers to the thickness of the Sankey diagram arrows.

AC4.7: This AC has improved over each series and is now generally well answered with candidates explaining how the quality of the data can be improved.

AC5.1: This AC was generally well done.

AC5.2: Candidates used suitable sizes and scales more consistently this year and drew an appropriate line of best fit. After my comments last year some centres are now marking this too severely.

Task 4
AC2.1: The majority of candidates achieved bottom band and low middle band marks for this. In order to achieve a top band, candidates should give a clear and detailed description of a range of fundamental concepts relating to energy.

AC2.3: The majority of candidates performed badly in this AC. To get out of the bottom band I would have expected to see some description of the working of both devices in a reasonable amount of detail. Candidates should discuss the conservation of energy in the context of the practical tasks in order to attain a top-band judgement.

AC3.2: This criterion was generally well attempted.

AC5.3: This criterion was generally well done.

AC5.4: In this criterion the candidates should make recommendations from their own work.

AC5.5: Most candidates produced structured reports using appropriate language, punctuation and grammar. It must be noted that centres very rarely gave full marks even for excellently written reports.

Activity 2

Task 1
AC3.1: This criterion was generally well done by candidates.

AC4.1: Most candidates produced a table and/or proforma to show the information they needed to collect in order to perform the audit and/or gave good written descriptions.

Task 2
AC4.5: Most candidates made good attempts at calculations involving R- and U-values and pay-back times.

AC4.6: When this criterion was attempted, candidates generally plotted a relevant chart.

AC4.7: Candidates made good attempts at evaluating their procedures. For a top band to be awarded candidates are required to evaluate the method thoroughly and describe actions that can improve the quality of the data.

AC5.1: For this criterion all candidates drew tables, but only some of their tables showed relevant information extracted from the task and calculated data.

AC5.2: This criterion was generally well done.

Task 3
AC1.1: Candidates need to use the accepted definition of sustainability and then expand on this by giving examples of methods of reducing dependence on non-sustainable fuels.

AC1.2: Candidates seemed to have difficulty with this criterion. There are four areas mentioned in the specification; if only one area is discussed then candidates can achieve the lower band; if two areas are discussed or three areas (but done poorly) candidates can achieve middle band marks; all four areas done well will allow candidates to achieve top band marks.

AC2.2: To get more than bottom band, as well as basic conservation of energy, candidates need to explain conduction and convection in terms of particles, what is meant by thermal conductivity, and how texture and colour effect absorption and emission of IR radiation, and relate these things to the house in question.

AC2.3: The working of a solar panel needs to be explained in detail to obtain top band marks for this criterion. Candidates again need to achieve the bullet points in the specification in the context of the assessment.

AC3.2: For this criterion, candidates were generally able to explain how energy is lost from the building as a whole. To improve attainment in this criterion they need to further identify by what methods heat is lost from the building.

AC3.3: This criterion was generally well attempted although there was some evidence of too generous marking here. In order to achieve a top-band, candidates should give clear and detailed reasoning of significant ways to reduce energy loss from a system.

AC5.3: Few Sankey diagrams were drawn for this task.

AC5.4: This criterion was generally well done.

AC5.5: Most candidates wrote good structured reports using appropriate language, punctuation and grammar. Candidates who have written excellent complete reports with no obvious mistakes in spelling punctuation or grammar should be awarded full marks.

Summary of key points

- This is a major piece of work based on two full scientific investigations, research and a real-world energy audit scenario. It is pleasing to see that year on year the overall quantity and quality of the assignments is improving. Candidates are now more likely to attempt all the assessment criteria and there was a noticeable decrease in the number of zeros awarded.

- In practical investigations (Activity 1) candidates are showing more of an awareness of the need to plan what they are going to do and how they will record their results.

- Candidates are producing far better results tables and they explain the calculations used. Graphs and Sankey diagrams are still variable in accuracy.

- Conclusions tend to be good but there is still room to improve in the evaluation of the method.

- In Activity 2 candidates are better at giving evidence of time management and in the design of their audits. However they still struggle to effectively evaluate and make full recommendations based on their calculations.

- There is still a weakness in the research aspects of both of the activities with candidates showing little evidence of the driving factors of sustainability or explaining fully how electrical energy is generated in a range of devices and only describing methods in heat transfer in a basic way if at all. Very few candidates go on to explain thermal conductivity and the use of R and U-values.

ENVIRONMENTAL SCIENCE

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UNIT 2

General Comments

New centres submitted work for this unit in May 2019, with the majority of candidates submitting work in English, as opposed than Welsh, for the third year in a row. Administrative work was correctly submitted, with authentication sheets signed by all candidates. However, mark record sheets are two-sided documents which should be submitted, with the candidates signing section 1 and the external assessment mark sheet included.

There is a clear contrast between the marks allocated to students who have labelled each section with the appropriate AC code and those who have not – it appears this is an indicator of the extent to which students have been prepared**.**

Comments on individual questions/sections

Task 1

AC 4.1 (to obtain data about ecosystems) requires candidates to provide a clear plan, linking the data required with the methods they plan to use to collect the data. This was generally completed well, as responses are clear and well presented.

AC 4.2 was rewarded appropriately where candidates were able to describe realistic precautions to be taken. However, many candidates' responses were superficial and lacked scientific rigour. This strand has improved from last year.

Task 2

AC 4.3 and **AC 4.4** were achieved through a range of tally charts and results tables with varied degrees of labelling. Candidates accessed band 3 marks where they were able to demonstrate data that was appropriate and tabulated in a well-organised manner.

Task 3

AC 1.4 generally scored fewer marks in activity one than in activity two, with many candidates failing to include any relevant detail. Where it was completed well, candidates included a range of factors in detail.

AC 2.1 and **AC 2.2** were generally completed with less detail, and most candidates scored fewer marks, in activity one than in activity two. The degree of detail regarding human impact was generally only sufficient to receive band 1 marks, with few exceptions – 9 marks are available for AC 2.2, so candidates are expected to devote more attention to this section.

AC 4.6, which requires candidates to comment upon comparisons between the two locations, tended to be found with AC 2.1 and AC 2.2, and often lacks detail and clarity. In the case of centres who have dealt with AC 4.6 separately marks tend to be far higher.

AC 4.5 was generally completed very well this year, with many candidates achieving band 3 scores. Attention has clearly been paid to the teaching of the T-test and Simpson's indices, although some candidates are not aware of the significance of the final calculated figures. Marks were generally lower where candataes have only used Simpson's.

AC 4.7 generally scored marks up to band 2 and consisted of comments related to graphs and raw data. Where candidates were able to link to methods of data collection and processing they were able to access marks in band 3 – responses linked to this strand have improved again this year.

Summary of key points

- Please ensure that candidates carry out the correct task – these change on an annual basis and are available on the WJEC secure website.

- Online CPD material for this unit can be found on the Environmental Science webpage.

ENVIRONMENTAL SCIENCE

Level 3 Diploma / Extended Diploma

Summer 2019

UNIT 3

General Comments

Generally, the work submitted for moderation was well annotated by the teacher and the Mark Report sheet correctly completed.

The key to candidates achieving good marks for the assessment criteria is that they show they can apply their knowledge, understanding and skills in the **context** of the assignment. In order to do this, candidates need to be trained to apply their knowledge in an environmental context before commencing the assignments, otherwise they will be disadvantaged.

This unit is assessed by a carrying out a number of tasks, all of which are set in an environmental context. I will comment on key aspects of the completion and assessment of the model assignment.

Generally, the moderator agreed with the marking of assessment criteria in learning outcomes 3 and 4; most disagreements lay in learning outcomes 1 and 2, and with a few disagreements in learning outcome 5. The result of this was that many centres were judged to be too generous in their marking with a number falling outside of tolerance.

I will comment where disagreements were more likely seen for the individual assessment criteria.

Comments on individual questions/sections

Activity 1 – Analysis of Stream Water

Task 1 *Planning and sampling*

AC3.1
This AC is about planning to sample. What equipment is needed? Where will the sample be collected from? As last year, some plans did not read as plans but appeared to be written after completing the activity. Candidates do need some guidance and practice on writing plans before commencing this activity.

The second statement in each band refers to identifying suitable sampling points. The content refers to accessibility, safety and ease of access. Not all these points were always covered.

Task 2 *Analysing the sample by volumetric analysis*

AC3.4
In a few cases, candidates did not read the burette to two decimal places. This restricts the marks to the first band. Please ensure that candidates know how to read and record the volume from a burette to two decimal places.

Task 3 *Writing a report on their findings*

AC2.1
This was often generously marked. This AC requires candidates to **explain** the choice of the sampling technique **and** the analytical procedures used. The response must be linked to the investigation carried out by the candidate (sampling river water, alkalinity of water and nitrate content). The answer should make reference to sampling methods and analytical methods used. It may be a good idea to teach candidates to look at the headings in the content section of the specification when they respond to this.
In some cases, the rationale for the choice of techniques and the plan were mixed together. Candidates may find it easier to meet the criteria if they separate the plan from their rationale.

AC2.4
Candidates only need to comment on the actual titration they used in the assignment. The idea that a solution of known concentration and volume is used to measure the concentration of an unknown solution of known volume; that the end point (i.e. point of exact neutralisation of acid by base) is determined using an indicator; that volumes are measured accurately using appropriate apparatus; is what we expect from candidates. It is not necessary for candidates to recall indicator theory.
A detailed description of the method is not required.

AC4.5
This was better done this year but significant figures are still a problem for many candidates. Either far too many significant figures are used or worse, there is excessive rounding up of figures. The latter error was not always appropriately penalised by centres.

AC5.3
There is not a requirement for learners to word process this report although it can be done, if the centre wishes.

Activity 2 – Drums in the Stream

Task 1

AC1.1
Once again, it did not appear that all candidates listed the possible functional groups which contain carbon, hydrogen **and oxygen** before they started the task. Listing functional groups which did not contain oxygen shows a misunderstanding of what they were asked to do. This should result in candidates losing marks.

After completing the analysis, they should give as full information as possible about the organic compounds that they have analysed.

AC1.2
This was generally well done this year.

Please note that band 2 and 3 require candidates to write balanced ionic equations as well as full symbol equations. Failure to give state symbols and ionic equations limits the marks candidates can achieve.

Activity 3 – Contamination in the Niger Delta region

Task 1

This task does not need to word processed but candidates must use Excel to plot the graph and use it to draw a trend line through the origin for the data. This way in Activity 1 they will have hand-written graph and in Activity 3 they will have generated one using Excel.

Task 2

The model assessment reads 'Write a technical report, using a word processor …' This can be amended so candidates are not required to use a Word-processor but bear in mind the mark above concerning the use of Excel.

AC2.2
The responses given to this AC are often very generously marked and the moderator finds himself in significant disagreements with the centre.
Candidates simply need to apply their understanding of how chromatography separates components to HPLC. Candidates need to ask themselves, what happens in the column to enable separation to occur?
They do **not** need to describe the other forms of chromatography. Neither is it necessary to describe the instrument used or give diagrams of the equipment.

AC2.3
Once again, this criterion was generously marked by centres. A description of the equipment used is not required. Diagrams of the equipment are not expected.
Please do not be surprised if most of your candidates struggle with what is required of them. This is possibly the most difficult AC for candidates to do and it is not expected that many candidates will achieve a middle or upper band mark.
Mark it in accordance with the band descriptors. Candidates in other centres will struggle with this AC too. Awarding will take into account the challenge of the assessment as a whole.

AC5.1
The moderator felt that some centres generously marked this AC. If units are repeated in the body of the table then they can be awarded a top band mark. If the tables are poorly structured, then the mark may be only band 1 or at best the bottom of the middle band.

AC5.2/5.3
The moderator understands that these criteria can be difficult to mark. Marks tended to be a little generous. It is important that candidates' comments are linked to the procedures used and the context of the assignment.

AC5.4
Some generous marking was noted for this criterion. It is very difficult to get to the top of band 3 and we do not expect to see many candidates scoring 8/9 and very few 9/9.

Summary of key points

It is important that candidates respond to the criteria in the context of the assignment. Generic responses should not be generously marked.

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UNIT 4

General Comments

- Better quality answers were seen this year compared to previous years but longer explanations were often confused.
- An improvement was seen in the recall of chemical tests.
- Candidates showed good knowledge of experimental design, energy transfers and how to select and use data.
- Improvement is required in understanding of the ozone layer, nuclear fission reactions and eutrophication.

Comments on individual questions/sections

Q.1   The vast majority of candidates could state the link here.

Q.2   **(a)**   It appears that many candidates had not learnt this and just guessed a location in the atmosphere.

   (b)   Some candidates stated that "R-22 is a free radical" rather than discussing how the free radicals were formed. Few candidates scored full marks though the majority knew the formula of ozone and that chlorine was involved.

   (c)   The modal mark here was 2, with candidates able to determine the increase and decrease but not using data from the graph of the maximum for the third mark.

   (d)   **(i)**   A great variety of structures were seen here. Radicals were accepted if the unpaired electrons were shown. Molecules showing hydrogen forming multiple bonds were not allowed.

      (ii)   This question was poorly answered.

Q.3   Full marks were awarded for the correct answer and just under half the candidates followed the line of energy to gain these marks.

Q.4   **(a)**   The most common answer here was 0.74 where candidates had used the log instead of the negative antilog. The majority wrote the correct equation for a pH calculation (though this did not gain any credit).

   (b)   Many candidates could recall the test reagent here, though some confusion was seen between Fe^{2+} and Fe^{3+} in the colour of the precipitate and a few candidates that stated the colour failed to mention the precipitate.

Q.5   **(a)**   The majority of candidates extracted this information straight from the resource booklet, including specifics and more detail that was required. These candidates gained full credit.

(b) Many candidates here gained two marks for "pioneer species" and "climax community" but did not discuss why these two terms were applicable to the figure.

(c) **(i)** This question was poorly answered with many candidates just stating that limescale did increase the rate of biofilm or *Legionella* growth, rather than suggesting why.

(ii) Here the majority of candidates discussed biofilm growth rather than the efficiency of the air conditioning system as a whole. This was not credited.

Q.6 **(a)** This question was poorly answered. "Chelating agent" was not an acceptable answer, though "forms coordinate bonds" was allowed.

(b) **(i)** A lot of confusion between oxidation and reduction was seen in this question. Redox was accepted.

(ii) Many vague statements about electrons being lost and gained were seen here, though for credit candidates had to state that the copper ion gained an electron. Answers about cyanide ions were common.

(c) **(i)** The majority of candidates were awarded this mark.

(ii) A lot of answers were seen about the amount of water in the lake and water flow, both of which did not gain credit.

Q.7 **(a)** Many candidates neglected to mention nuclei in this question. The modal mark was 1 for the term "chain reaction".

(b) **(i)** Most candidates could identify control rods but did not describe how they are used for the second mark.

(ii) Vague statements about the rate of fission were often seen here, rather than referring to the speed of the neutrons.

(c) **(i)** Candidates were familiar with the properties of alpha particles, with many answers referring to "skin", "paper" and/or "ionising" but only a few could describe the structure.

(ii) Most candidates gained credit for the four half-lives or their workings of how many divisions were required and approximately half of the cohort scored both marks.

Q.8 **(a)** Few candidates linked fertilisers to nitrates. The vast majority mentioned algal blooms but there was a lot of confusion about the lack of photosynthesis at the bottom of the lake leading to low oxygen concentrations or fish dying because they didn't have any sunlight.

(b) Many candidates had a very superficial knowledge of anaerobic respiration so answered this question poorly.

(c) No candidates scored three marks here, though most could define the role of saprobionts as being linked to decomposition. Some continued on to their respiration but many failed to mention carbon dioxide, "carbon" alone was not credited.

(d) The most common incorrect answer here was "light" with no reference to intensity. Some candidates also erroneously listed water as a factor.

Q.9 **(a)** **(i)** This question was answered poorly. A lot of confusion was seen here about the ozone layer as opposed to tropospheric ozone formation. Some answers referred to nitrogen dioxide being formed in catalytic converters, showing a lack of understanding.

(ii) Most candidates scored both marks here.

(b) This question had better quality answers than in previous years, showing that candidates had heard of a temperature inversion but few comprehensive answers were seen.

(c) Most candidates gained credit here, though many listed weather conditions or time periods separately which limited their score. Comparisons with background pollution were often poorly phrased, with many giving answers such as "chimneys from houses nearby" or "local factories" so could not gain credit.

Q.10 **(a)** **(i)** Most candidates gained this mark. Those who didn't had often just stated one (correct) wavelength.

(ii) A lot of answers were seen about chlorophyll with no mention of absorption or reflection of wavelengths.

(b) This question was answered poorly. "Thylakoid" alone was not credited.

(c) **(i)** The most frequent answer seen here was "ATPase" which was not accepted.

(ii) Responses were polarised here with candidates either giving a superficial answer about enzymes in general or giving a detailed explanation.

(iii) Most candidates did not gain this mark.

(d) **(i)** Few candidates made the link here that UV rays can damage plant DNA.

(ii) This question was poorly answered with many responses referring to animals' "skin" or "fur" rather than their ability to move.

Q.11 **(a)** Most candidates referred to wind and acid rain here, though they could not expand on how trees were damaged.

(b) This question was poorly answered with many candidates referring to the removal of solid sulfur particulates rather than acidic sulfurous gases, which did not gain credit.

(c) Many incorrect answers were seen here relating to the green house effect or ozone layer.

(d) **(i)** Just under half of candidates gained credit here.

(ii) The majority of candidates were awarded this mark, with the most common answer being magnesium.

(e) Most candidates could describe the energy transfers and gained both marks.

(f) **(i)** Definitions of efficiency were often poor, with candidates referring to wasted energy rather than total energy input.

(ii) Half of candidates correctly calculated the remaining wasted energy, with the most common error being that the useful energy was ignored.

(iii) A plethora of different approaches to Sankey diagrams were seen. Frequently, candidates scored two from a labelled, correctly scaled diagram just showing input, wasted and useful percentages. It was expected that candidates would use all the data they had been given. Other common errors were omitting the input energy and energy output not adding up to 100%.

(iv) Most candidates could suggest a suitable answer here.

Summary of key points

- Most candidates made a good attempt at the paper this year but some showed a lack of preparation for more complex explanations (ozone layer, nuclear fission reactions and respiration)

- A few candidates left a significant number of blank responses throughout the paper showing that, rather than having insufficient time, they found some questions inaccessible. Practising past papers may aid candidates in this respect, and underlining key words in questions should be encouraged.

ENVIRONMENTAL SCIENCE

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UNIT 5

General Comments

It is important that the candidates apply their knowledge to the context given. This was not always done. The following comments for each assessment criterion will expand on the implications of this, where relevant.

Comments on individual questions/sections

Activity 1

AC2.1 It is important that this assessment criterion is evidenced from the context. The candidate only needed to deal with the terms relevant to heavy metal contamination and the provided data.

AC2.2 This was reasonable well described.

AC2.3 How may copper and cadmium interact with the physical environment, i.e. with soil and water? Only content relevant to heavy metals needed to be selected.

AC2.4 Once again this needed to be answered with consideration to the context of contamination by copper and cadmium. There was no need to deal with eutrophication or damage by pollutants such as SO_3 and SO_2.

AC2.5 Some relevant comments were made particularly about the impact of cadmium on human health.

AC3.1 This was answered in a rather 'generalised' manner. What legislation is there that will have a bearing on contamination from heavy metals?

AC3.3 This was reasonably done than some other parts although work tended to be brief. There is no need to deal with contamination by hydrocarbons in the context provided in this assignment.

AC4.1 / AC4.2 Some relevant consideration was given to the significance of most of the data given in the assignment.

AC4.3 Both the PowerPoint presentation with speaker notes and the report were assessed in this part. Candidates do need some instruction on producing PowerPoint slides in an appropriate format. Dense texts on slides is likely to reduce the final mark.

Activity 2

AC1.1 The terms point source, non-point source, primary and secondary pollutant were explained. There was no need to comment on radioactive contamination, air pollution in the context of this assignment.

AC1.2 This needed to be answered in the context of the assignment i.e. contamination of the river by neonicotinoids.

AC1.3/1.4 Candidates needed to consider how waste containing neonicotinoids may be disposed and result in environmental contamination.

AC2.1 This must be applied to the context given. There was no need to review terms which were not relevant to the context.

AC2.4 Once again it is important to consider the context of the assignment. How do neonicotinoids interact with the biological environment?

AC3.2 There were some suggestions made about how neonicotinoids may be reduced. It is important to consider potential sources of contamination from those implied by the map.

AC4.1/4.2 There was very little evidence that thought was given to the data given in the assignment.

AC4.3 A well-produced poster was seen.

Summary of key points

- The key to success is making sure that responses are based upon the context of the assignment and any information supplied. At all points the candidates should ask the question, how do I respond to this criterion in the light of the context of the assignment?

ENVIRONMENTAL SCIENCE

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UNIT 7

General Comments

Administrative work was correctly submitted, with authentication sheets signed by the candidates. All of the work submitted was very well annotated and AC's were clearly referenced in the margin, which aided the moderation process.

Comments on individual questions/sections

Activity 1

AC 1.1 - This AC was generally well done by candidates.

AC 2.1 - In order to award a top band judgement, candidates should note a detailed method for the collection of data (air / soil sampling) or survey procedures.

AC 3.1 - This AC was generally well done by candidates.

AC 3.2 - This AC was generally well done by candidates.

AC 3.3 - This AC was generally well done by candidates.

AC 4.1 - This AC was well done by candidates.

AC 4.2 - This AC was well done by candidates.

AC 4.3 - This AC was well done by candidates.

Activity 2

AC 1.2 - In order to award a mark in the top band, candidates should give an in-depth explanation of how the combustion of fuels by transport systems produce air pollutants.

AC 1.3 - Candidates tended to give coherent explanations of how weather conditions can affect pollution from transport systems; however, a top band response would be expected to contain a detailed account of photochemical and free radical reactions.

AC 1.4 - This AC was generally well done by candidates.

AC 1.5 – Centres should remember that in order to award a top band mark, the assessments of how transport systems impact on the climate should be supported by reasoned judgements.

AC 1.6 - This AC was generally well done by candidates.

AC 2.2 - This AC was generally well done by candidates.

AC 2.3 - Candidates made judgements evaluating given data that were mainly suitable; however, little comment was made of its reliability, accuracy or the credibility of its source. This would be expected of work awarded a top band mark.

Summary of key points

- This year was the first time for candidates to submit work for this unit.

- Centres are reminded the Guidance for Teaching document amplifies the specification content.

ENVIRONMENTAL SCIENCE

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UNIT 8

General Comments

One centre completed this unit. The work produced to complete both tasks showed that candidates had developed a detailed understanding of the interaction between agricultural systems and the environment. The work was presented in a clear and well organised format with suitable headings and sub headings, and diagrams labelled and referenced clearly.

Comments on individual questions/sections

LO1 completed in detail as introduction to task 1.

LO2 task 2 showed that candidates had undertaken detailed research in order to complete task 2. Good use of diagrams to explain difficult processes.

LO3 and **LO4** In task 1 - the assessment criteria were mainly met with the required detail and understanding, but some aspects of the task, in particular identifying strategies to support biodiversity, were answered unrealistically and did not refer specifically to the farm and habitats identified in the task.

Candidates also did not discuss the advantages and disadvantages of organic farming in sufficient detail.

Candidates were able to succinctly summarise how regulation at different levels impacts agriculture.

The plan in task 2 was detailed and incorporated actions and timelines. Good use of relevant research and language ensured the work was pitched at the correct audience.

Summary of key points

- Both tasks were completed well and candidates showed a good understanding of how agriculture impacts upon the environment.

- Work was clearly set out and suitable for the intended audience.

- Improvements would be to identify more farm-specific biodiversity improvements and to discuss the advantages and disadvantages of organic farming.

ENVIRONMENTAL SCIENCE

Level 3 Extended Diploma

Summer 2019

UNIT 9

General Comments

This was the first time that this unit has been assessed and there was a very small entry cohort this year. Candidates would have benefitted from starting this unit earlier in the year, although the overall quality was good. The project titles that can be chosen by candidates is set each year by WJEC although they generally follow the same themes.

In short, candidates need to collect large amounts of data to truly get the most from the markscheme, and it is suggested that they need to start early on this Unit. Although we accept that candidates are likely to be doing this Unit in the second half of their course, it is suggested that this is better off started in the summer and the autumn, when the weather is much better to allow for greater access to fieldwork data. If candidates are looking to monitor environmental change over time, the earlier they start the better.

Centres are reminded to ensure that their candidates have access to the approved checklist.

Comments on individual questions/sections

AC1.1 Describe an environment

In this AC candidates are asked to describe the significant aspects of the environment clearly and accurately. We are looking for candidates to survey the chosen environment and identify and describe the important aspects (more than one). Candidates generally need to identify more aspects, as these set the scene for the analysis and lead the data capture. We would like to see a thorough survey of the chosen environment with annotated photos/maps/diagrams if relevant. This AC was performed well this year.

AC1.2 Assess the impact of change on an environment

The key to this AC is to be very clear about the changes that are being monitored. Most of the approved investigation titles involve analysing the effects of human activity on a chosen environment so centres need to be careful about advising candidates to choose those where the human effects are obvious. Candidates this year did not fully assess all the important impacts of change in detail and accurately.

AC2.1 Plan an environmental analysis

Candidates should explicitly use the SMART acronym and should be very explicit about the time frames involved with the investigation. A plan to collect comprehensive field data, including all the relevant (and specific) equipment should be included in this section of the report. Although candidates this year were able to use the SMART acronym well, the specific nature of equipment needed more detail.

AC2.2 Draw up a risk assessment

Following on from GCSE Sciences, it is expected that candidates will identify all the relevant specific natures of the hazards, for example, if a candidate is heating soil to determine humus content then – 'the heating apparatus is hot'. They should then state the possible risk outcomes with actions, such as, 'the hot metal tray could burn skin during handling following heating', followed by suitable control measures, such as 'wear heat proof gloves or use tongs when removing the metal tray from the heating apparatus'.
Candidates should check to ensure that they do not miss obvious important hazards. This assessment criteria was completed to a high standard this year.

AC2.3 Justify plan for environmental analysis

In this AC it is expected that candidates will explain the reasons why they have chosen to perform the investigation, the way that they have planned it. A good word to remind candidates to use is the word 'because'. They need to justify all the: SMART objectives; environmental changes; information required to make judgements; suitability of methods and the Health and Safety considerations of the sampling proposed. This AC needed more detail and greater consideration of all the parts of the plan.

AC2.4 Describe assessment methods used in environmental analysis

In this AC Candidates should implicitly use skills, knowledge or understanding from the other units that they have studied to give clear, detailed and accurate descriptions of all the assessment methods used to analyse the data from their investigation. It is expected that any mathematical techniques used to process the data would be described in this section. Candidates this year did not do this section clearly and in enough detail.

AC3.1 Obtain data from scientific investigations

It is expected that candidates will collect a range of different data from their investigation. This needs to be over as wide a range as possible and repeated as is necessary. Candidates should consider and discuss the expected tolerances of any measurements. If candidates are performing repeat surveys over time, they should be given the appropriate opportunities to do so and should be reminded of the need to start early on the measurements. It was felt that candidates this year could have and needed to, collect more data.

AC3.2 Record data from investigations

All primary and any relevant secondary data should be recorded consistently, with precision and in suitable formats. This will include any anomalies, which should be clearly identified. It is expected that candidates at this level should clearly quote correct units and use clear data headings on any tables. This was the lowest scoring AC this year, and it is suggested that centres need to revisit examples of suitable data recording formats with their candidates.

AC3.3 Process data

Any data collected should be processed systematically and accurately using appropriate techniques. Candidates should be encouraged to use more statistical methods to analyse larger data set, moving beyond simple identification of anomalies and calculation of means. It is expected that candidates will use a range of presentation techniques to present the data, particularly in graphical formats such as line graphs, charts, kite diagrams and pie charts.

Any mathematical or spreadsheet processing should be included as relevant appendices. It is also expected that candidates will make appropriate use of significant figures. The presentation of data was relatively simple and straightforward this year, and the limited data recorded hindered candidates accessing higher marks.

AC3.4 Evaluate data and procedures

In this AC candidates should give clear, detailed and accurate evaluations of the quality of the primary data obtained. This should include assessing data in the usual scientific ways such as: repeatability; ranges and error analysis.
Candidates should also assess the procedures used. It is expected that candidates should be critical of their approaches and should also suggest improvements where necessary. Again, the limited data collected by candidates this year disadvantaged their ability to fully evaluate their work.

AC4.1 Propose strategies to protect an environment

Following the analysis of any data collected, candidates should then propose ways to protect their chosen environment from human activity. It is expected that candidates will come up with a range of different suggestions, with associated detailed strategies to address the suggestions. Although candidates this year could propose some strategies, these were rather limited in extent.

AC4.2 Justify proposed strategies

Any strategies proposed in AC4.1 should be clearly justified in detail. This AC was hindered by the limited strategies proposed in AC4.1.

AC4.3 Communicate strategies to an audience

In this AC the candidates' ability write a report is assessed. The report should be clear and concise and have an obvious structure. Scientific and technical language should be appropriate to the audience and should have accurate spelling, punctuation and grammar. Any researched information should be fully cited and referenced fully and accurately. A suitable referencing system such as Harvard should be used.
Candidates this year produced limited citations and needed more comprehensive referencing. The quality of the English was good however.

Summary of key points

Please can centres:

- Start this unit early.
- Remind candidates to include preliminary survey information such as photos/maps.
- Advise candidates to choose investigations with clear human influences on the environment.
- Go through the key points of how to construct a suitable risk assessment.
- Encourage candidates to analyse any data using suitable mathematical/statistical techniques beyond simple mean averaging.
- Ensure that candidates collect more data.
- Remind their candidates about the correct formats for recording data.
- Suggest that candidates use a range of different ways to present their data.
- Make sure that candidates propose several different ways to protect their chosen environment.