Commentary on candidate evidence

Candidate 1 – the effect of water velocity on freshwater invertebrates

The evidence for this candidate has achieved the following marks for each section of this course assessment component.

Section	Mark available	Mark awarded		Comments
1. Aim	1	1		The aim clearly describes the purpose of the investigation.
2. Underlying environmental science	3	2		A reasonable understanding of relevant environmental science is demonstrated, with discussion of oxygen supply, indicator species and the effect of pollution/eutrophication. Some confusion between BOD and dissolved oxygen content is apparent, and bioaccumulation is irrelevant in this context. The paragraph discussing velocity has been copied verbatim from the website; this does not demonstrate an understanding of the underlying science.
3. Data collection and handling	5	a	0	The candidate has not demonstrated the ability to summarise the method. It would have been sufficient to say that the velocity of the water was measured using a hydro prop and stopwatch, before sampling the invertebrate species present using kick sampling and identification keys.
		b	0	The candidate has not included the raw data from the time measurements.
		c	0	The field work data are not tabulated correctly as the velocity unit has been omitted from the first table. Also, the 'species present' table does not give any indication that the values relate to the counts of each species present.
		d	1	Data relevant to the investigation has been obtained from an external source.

		e	0	A citation for Source 2 is included within the body of the report, in a format that links with the reference section. However, the nature of the source (a handout) is such that it is not possible to provide an appropriate reference; where a single investigation has been carried out, comparative data must be obtained from an internet or literature source ie, website, journal, book or map. In this case, the Source 2 data were obtained from a handout provided to students visiting a fieldwork centre and therefore are not published in the required format.
4. Graphical presentation	4	a	1	A scatter graph is an appropriate format for assessing a relationship between two variables.
		b	1	The axes on the graph have suitable scales. The *x*-axis scale on the Source 2 graph would have benefited from starting around, for example, 0.3, but plotting of the points can be checked and the trend can be clearly seen.
		c	0	The velocity unit does not appear on either graph.
		d	1	The data points have been plotted accurately using a computer graphing programme, with minor gridlines and a line of best fit included.
5. Analysis	2	a	1	The fieldwork data are appropriately compared with the Source 2 data.
		b	0	The formula for calculating velocity is included (in the underlying environmental science section) and a table showing calculated velocity at each sample site has been provided. However, it is not possible to determine if the velocity formula has been correctly applied; this could be overcome by having included the measurements for time and then including a worked example. The species richness calculation is a simple count of the number of species present at each sampling point and is not considered to be an appropriate extended or statistical calculation.
6. Conclusion	1	1		The conclusion relates to the aim and is supported by all of the data in the report.

7. Evaluation	3	3	Three valid evaluative statements are provided on improving reliability by increasing sampling, taking care not to adversely affect other sampling sites, and additional investigations that could help explain unusual findings.
8. Structure	1	1	A clear and concise report with an informative title.
Total	**20**	**13**	

Candidate 2 – Abiotic factors and primary succession across a sand dune

The evidence for this candidate has achieved the following marks for each section of this course assessment component.

Section	Mark available	Mark awarded		Comments
1. Aim	1	1		The aim clearly describes the purpose of the investigation.
2. Underlying environmental science	3	3		A good understanding of the underlying environmental science is demonstrated, at a depth at least appropriate to Higher, with discussion of changes in vegetation across sand dunes and the associated modifications, including their role in dune stability.
3. Data collection and handling	5	a	1	The overall experimental procedure can be visualised from the description provided.
		b	0	Two fieldwork activities were undertaken. The raw data from both are insufficient, with only partial replication due to time constraints (particularly for the infiltration investigation).
		c	0	Data, including derived values, are presented in tables but these lack appropriate column headings and units.
		d	1	Data relevant to the aim have been obtained from a second field work activity, therefore the data from a literature source, which relates to lichens and vascular plants on sand dunes, is disregarded (in this section only).
		e	1	As two fieldwork activities have been undertaken, the reference must be to a source of information gathered to assist with the account of the underlying environmental science. An appropriate citation and linked reference have been included (Dargie), with the citation within the body of the report and the reference at the end. The first reference has been cited using a full URL and the last reference has been cited by giving the full reference, however, the Dargie and Crawford references have both been cited and referenced correctly.

4. Graphical presentation	4	a	0	Two line graphs are included, which is an appropriate format for continuous data such as infiltration rate or wind speed. However, on both graphs the *x*-axis displays categories rather than continuous data and therefore a bar graph would be appropriate in this case.
		b	1	In addition to incorrect format, there is a plotting error on graph 1 (point 2); other than format, presentation of graph 2 is correct and marks are therefore awarded for this graph. The axes of the graph have suitable scales.
		c	1	The axes (on graph 2) have suitable labels and units.
		d	1	The data points (on graph 2) are accurately plotted.
5. Analysis	2	a	1	The graphs have been correctly analysed. The mark is awarded for one correct analysis and the analysis of the data collected through fieldwork meets the requirement.
		b	1	Two percentage changes have been calculated. The mark is awarded for one correct calculation.
6. Conclusion	1	0		The aim here was to investigate how two abiotic factors associated with succession zones change across a relatively recently formed sand dune system. The conclusion makes appropriate reference to infiltration and wind speed decreasing moving inland from the strandline and also associated changes in vegetation suggested by a literature source. However, the assertion that these changes are due to plant succession relies on data from 1985 and, which extends only 131 metres from the strandline (only half the distance assessed in the candidate's investigation); therefore the claim cannot be proved without undertaking a vegetation survey.

7. Evaluation	3	2	Three evaluative statements are made. The first refers to shortage of time limiting the collection of replicate data for infiltration rates and how this would affect accuracy; taking repeated measurements and calculating a mean value would improve both reliability and accuracy as the mean value should be closer to the true value. The second evaluation comments on the daily variation of the measured abiotic factors and a way to overcome the impacts of this, which is appropriate. The third statement relates to the potential value of finding a relationship between infiltration rate and the amount of organic matter and moisture in collected soil samples, which was not part of the aim of this investigation.
8. Structure	1	1	The report is clear and concise and has an informative title.
Total	**20**	**15**	

Candidate 3 – Tree growth in a plantation

The evidence for this candidate has achieved the following marks for each section of this course assessment component.

Section	Mark available	Mark awarded		Comments
1. Aim	1	0		The aim does not clearly describe the purpose of the investigation and is too vague. The candidate is actually investigating the variation of girth in relation to stock density but doesn't state this (or similar).
2. Underlying environmental science	3	2		A reasonable understanding of relevant environmental science at a depth appropriate to at least Higher level is demonstrated. This includes the characteristics of plantations and stocking density.
3. Data collection and handling	5	a	0	The ability to summarise the method has not been demonstrated, and the pieces of equipment used to identify the tree species and to measure the girth and distance to the nearest tree, have been omitted.
		b	1	The raw data from the fieldwork is sufficient.
		c	1	Data, including mean values, is presented in a correctly produced table.
		d	1	Data relevant to the investigation has been obtained from an internet/literature source
		e	0	A citation for the internet/literature source of data (as only one fieldwork investigation was undertaken) is located within the body of the report and a reference is included at the end. However, the format of the reference does not the meet the requirements for a book, lacking page number and edition/ISBN.

				The second citation and reference is discounted as it is not for the secondary source of data.
4. Graphical presentation	4	a	1	A scatter graph has been used, which is an appropriate format for investigating the relationship between two continuous variables.
		b	1	The axes of the graph have suitable scales. The graph would have benefited from having the *x*-axis scale start nearer the first plotted data point, but the plotting and distribution of points can be clearly seen.
		c	1	The axes of the graph have suitable labels and units
		d	1	The points on the computer-generated graph are accurately plotted, and a line of best fit and minor gridlines are included.
5. Analysis	2	a	1	The analysis refers to the relationship between tree girth and distance to the nearest tree, so is not a comparison of the fieldwork data with data from an internet/literature source. However, in the conclusion section, the data from the internet/literature source has been used in combination with the fieldwork data to calculate the mean age of the trees, and compared against information extracted from a map, which is a valid analysis (though not an appropriate extended calculation).
		b	0	A nearest neighbour analysis is appropriate to the investigation, but has not been correctly completed. As commented on in the evaluation section, the nearest neighbour value should fall between 0 and +2.15; a value within this range would be achieved by converting the mean nearest neighbour distance into metres.
6. Conclusion	1	0		The aim was to investigate the variation in tree trunk girth in a plantation. The conclusion should relate to the aim and be supported by all of the data in the report. The conclusion provided does not relate to the aim, nor is the extended calculation outcome referred to.

7. Evaluation	3	3	The candidate has made four evaluative statements, three of which are valid and supported by appropriate justification (1st, 2nd and 4th). The third statement of rounding the girth measurements to the nearest centimetre would have little impact on the mean value.
8. Structure	1	1	The report is clear and concise with an informative title.
Total	**20**	**14**	

Candidate 4 – the build-up of carbon dioxide in a classroom

The evidence for this candidate has achieved the following marks for each section of this course assessment component.

Section	Mark available	Mark awarded		Comments
1. Aim	1	1		The aim clearly describes the purpose of the investigation.
2. Underlying environmental science	3	3		A good understanding of underlying environmental science at a depth appropriate to at least Higher level is demonstrated, with discussion of the effects of CO_2 at different concentrations, modern building design, and issues associated with the lack of movement in a classroom.
3. Data collection and handling	5	a	1	A brief summary of the approach used to collect experimental/fieldwork data is included.
		b	1	Sufficient raw data from the experiment/fieldwork is provided.
		c	1	Data, including mean values, are provided in a correctly produced table.
		d	0	The candidate has only carried out one investigation and has not included comparative data from an internet/literature source.
		e	0	As the candidate had only carried out one investigation they should have included a secondary source of data, and cited and referenced this secondary source. As they did not do so, they cannot access this mark.
4. Graphical presentation	4	a	1	A combination bar and line graph is included, which is an appropriate format when comparing the two variables.

		b	1	The axes of the graph have suitable scales.
		c	1	The axes of the graph have suitable labels and units
		d	0	The bars are plotted accurately but it is not possible to check the accuracy of plotting for the line graph due to the size of the markers.
5. Analysis	2	a	1	Analysis of both sets of collected data is included and are appropriate. The mark is awarded for a single appropriate analysis.
		b	1	A correctly completed extended calculation is included.
6. Conclusion	1	1		The conclusion is valid and is supported by all of the data in the report, including the estimated volume of CO_2 produced by the class.
7. Evaluation	3	3		Three evaluative statements supported by appropriate justification are provided. The first statement identifies a limitation in the experimental setup with justification. The second identifies a possible confounding variable and the effect it may have. The third statement is valid as the mean value should be closer to the true value.
8. Structure	1	1		The report is clear and concise and has an appropriate title.
Total	**20**	**17**		