edexcel

Examiners' Report/ Principal Examiner Feedback

January 2015

Pearson Edexcel International A Level in Biology (WBI06) Paper 01

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

January 2015
Publications Code IA040386*

Overall Impressions

The paper provided a good spread of marks and there were few blank spaces or incomplete answers. Each question yielded some excellent answers demonstrating both sound understanding of the biological principles and experience of the practical techniques involved. On the other hand, again this session some students gave answers that were extremely generic – sometimes to the point of making no reference to the practical context of the question. In some cases these answers appear to have been learnt in advance as 'formulae' for successful answers on this paper. Unfortunately such prepared answers are rarely effective in answering the questions set and tend to earn very few marks. This paper aims to reward students who understand the biology of the core practicals and the reasons for the techniques used, and who are able to apply their skills appropriately to new situations. As many previous examiners' reports have noted, the mark schemes from past papers may be useful for practice and to gain familiarity with the format, but these cannot be 'recycled' to provide answers for future papers.

Individual Questions

Question 1

1(a) Marks for this question were very evenly spread, with approximately the same proportion of students gaining each possible score from zero to five. Many good answers were seen, some going beyond the requirements of the question by including explanation of the working of the respirometer and the reason for absorbing carbon dioxide. Unfortunately, a sizable proportion of students did not attempt a description of any method or did not realise that a respirometer (or equivalent) was suitable. This is a little surprising since investigating rate of respiration is explicitly included in the specification. Various other irrelevant core practicals featured in answers, while some descriptions may have related to a respirometer but were so vague as to make it difficult to tell. However, in both these cases students were able to gain credit if they correctly manipulated temperature as the independent variable, even if they struggled with measurement of the dependent variable.

Mark points 1, 2, 3 and 5 were most frequently awarded. Some students attempted mark point 4, but this was often expressed as allowing the *seeds* to acclimatise to the conditions which is not quite the point – especially since this frequently took place *before* placing the apparatus in the water bath (at which point the temperature would change, changing the pressure and moving the bubble).
Some answers described the control of extraneous variables in great detail, and it is encouraging to see students recognising their importance, but marks were not awarded for controlled variables in part (a) since part (b) gives full credit for this aspect.

1(b)(i) Most students had no trouble producing two suggestions in response to this question, but in far fewer cases could two marks be awarded. This was because many students chose at least one variable which was not relevant to the experiment in question, or two very similar variables which could not justify the award of two separate marks. For example, "pH" was a common answer, but it was not at all clear what this response meant in the context of seeds being placed in a respirometer. Did students intend to control the internal pH of the seed? If so, it would be sensible to approach this through control of variables relating to the seed itself (such as species). pH alone was not credited as an appropriate controlled variable, however, students who thought a little harder about pH in the context of the experiment were credited for more specific suggestions such as the pH of the water applied to the seeds (to initiate germination prior to placing in the respirometer). Future students are encouraged to think carefully about which variables are relevant and appropriate to the technique in question, and to be specific about the variable they have in mind.

1(b)(ii) Students were not double-penalised here; even if the variable chosen was not really appropriate so was not credited in part (i), credit could still be gained for controlling this variable in a sensible way in part (ii). Nevertheless, students tended to score 1 rather than 2 marks. Two reasons for non-award of marks predominated - both of which have been highlighted in previous examiner's reports. Firstly, students continue to state methods by which a variable may be *monitored* rather than *controlled*, for example controlling light intensity using a light meter. (The light meter merely measures the light intensity, it does nothing to ensure that the

intensity is the same in each case.) Marks were not awarded for monitoring or measuring the variable; an active method of control that ensures the *same value* of this variable is needed. Secondly, students tend to be too vague when suggesting effects on the results. Statements such as "this would affect the results" or "this would affect the rate of respiration" are not sufficient; a reference to the nature of the change in the results is expected. The following is an example of a clear and specific answer that gained two marks:
"If a larger mass of seeds was present, more respiration would take place using a larger volume of oxygen, causing faster movement of the liquid in the capillary tube. This would be due to the mass of seeds not due to the temperature (independent variable)."

1(c) The marks suggest that students found this the most challenging question on the paper, perhaps because it pulled together knowledge and understanding from several different parts of the specification. Conversely, this also meant that there were several possible 'ways in' to the question, or lines of thought that would lead to sensible suggestions: consideration of the carbohydrates involved, the activity of enzymes or the stages of respiration itself. Full credit could be gained without detailed knowledge of germination, and students are encouraged to apply known biological principles to contexts that they may not have explicitly studied. Students are also urged to read the questions carefully. Some predicted the results of the experiment in part (a) and explained the effect of temperature on enzyme-controlled reactions in terms of kinetic effects – but this was not what the question asked for. Other students suggested that conditions (such as temperature or pH) might not be suitable for enzyme activity, or would slow the rate of reaction to an undetectable level – but the question stem specifically stated that conditions were suitable for germination, so this was not credited.

Question 2

The calculation of means and tabulation of data were particularly high-scoring parts of the paper, while this time the interpretation of the statistical test was less well carried out. It was pleasing to see students using the trend in the graph as a 'sense check' on the outcome of the statistical test – and in several cases the interpretation of the statistics was clearly reviewed following reference to the graph. The data were deliberately selected such that the trend was unambiguous to support students in reaching an appropriate conclusion, but sadly this did not help everyone. In many cases students gained credit for correctly describing the trend from the graph, even if they got stuck with the statistics.

2(a) Many correct null hypotheses were seen but, as in previous sessions, students continue to find it difficult to decide whether a correlation or a 'difference' is applicable to the scenario described in the question. In this session in particular students did not always state the independent and dependent variables precisely, some gave the alternative (rather than null) hypothesis, and a significant minority simply described the trend they might expect to see in the results.

2(b) Calculations were very accurate and almost all students earned both marks.

2(c) Most students produced an appropriate table. The most common mistakes were: vague headings that did not fully identify the variable; omission of units from

the table headings; inclusion of units (repeatedly) in the cells of the table; or omission of raw data.

2(d) This session seemed to see a dip in the quality of graphs produced by students, although the examiners did not feel that the data or experimental context of the question contained any particular pitfalls in relation to graphing. In particular, a sizeable proportion of students drew bar charts rather than scattergraphs, but a bar chart was not appropriate given that the independent variable was continuous (exposure time to UV light). Many students did not include range bars or any other indication of the variability of the data, although this was specifically mentioned in the question. Some axes were not fully or correctly labelled, and some students made the plotting unnecessarily difficult for themselves by choosing awkward scales. In general students are not penalised for selecting an awkward scale (as long as it is linear and large enough to be clear), but they will be penalised for any plotting errors that result from it. However, in extreme cases the scale chosen can impair the graph's function in communicating information clearly, and in such cases the scale mark is not awarded. Students are reminded that it is not necessary to choose absolutely the largest scale that will fit on the page if a slightly smaller scale would lie more sensibly with the divisions on the grid. It should be noted that the examiners did see a number of excellent graphs that scored full marks, and would like to recognise the efforts of teachers in promoting and practising hand graphing skills in an age where many graphs are computer-generated.

2(e) Most students gained mark point 1 for correctly describing the pattern of the results. Some went on to give very clear explanations of the biological reasons for the effects of UV light on bacteria, but in this case the marks were available for justifying the significance of the conclusion rather than the biological mechanisms. The negative value of the correlation coefficient meant that some students found the interpretation of the statistical test challenging, although some used common sense to reach mark points 3 and 4 even if they struggled with mark point 2. However, many students did not explain that the correlation was **significant** so could not be awarded mark point 4. In this case the examiners did not insist on reference to a *negative* correlation for mark point 4 since the question stem stated that a negative correlation was found, but students are reminded that it is good practice to specify whether a correlation is positive or negative.

2(f) Mark points 1 and 2 were frequently awarded, with students showing a good awareness of the significance of uncontrolled variables. It was pleasing to see many students also gaining mark point 3, recognising the important biological point of the variability between different strains of bacteria. Students are again reminded to read the question carefully. This question specifically asks about the *validity* of conclusions: many answers included points relating to the precision or reliability of the results, such as whether sufficient repeats had been carried out or whether the numbers of colonies were counted correctly. While these are sensible considerations, they were not credited because they did not relate to validity.

Question 3

The context of the investigation seemed accessible to the vast majority. In particular the independent variable was straightforward both to identify and to vary (by taking samples from different parts of the plant), which helped to set students off in the

right direction. By contrast, identifying the dependent variable and planning a suitable way to measure it proved much more challenging. In some cases a lack of clarity about the dependent variable also caused difficulties in part (d), if the student was unsure what data they were collecting and what units might be used.
A minority of students described carrying out plant tissue culture, presumably having tried to think of a core practical that they could do using small samples of different parts of a plant. However, these accounts tended to have very limited relevance to the investigation set and generally scored at the lower end of the mark range, although in some cases they were able to gain credit for correct application of of principles such as control of extraneous variables.
Students are reminded to use the headings of the different parts of the question (a-e) to help them to structure their answers. Past mark schemes may be useful as a guide to what should be included in each part (although of course the details of the marking points will differ depending on the context of the investigation). This is an examination paper and students are expected to answer the questions asked – which may not necessarily be the same as the structure and organisation of lab reports written for their own teachers.

3(a) Most students correctly identified a valid safety concern. Fewer answers gained marking point 1 as many searched about to try to find some kind of ethical issue, frequently coming up with a weak or invalid suggestion rather than simply stating that there were no significant ethical issues. The idea of potential damage to other species in the habitat through collection of the pigeon pea plant was accepted as a reasonable ethical issue, but it was disappointing to see the idea that the plant might suffer pain or that harvesting might violate its rights. A few students seemed to try to cover all bases by identifying safety and ethical issues **and** stating that there were no significant ethical or safety concerns. This is clearly a contradication that cannot be credited either way: students must think about whether what they are writing is sensible.

3(b) Students continue to find this the trickiest part of question 3, and it is a place where generic answers have a particular tendency to appear. Credit is given for the idea of practically determining appropriate methods and values of variables that would not be known without experimentation. The work must relate to specific parameters relevant to the context of the investigation. As has been previously mentioned in examiners' reports, students are encouraged to discuss the role and purpose of preliminary practical work with their teachers and centres are encouraged to give students the opportunity to engage in such work from time to time. Of course it is time-consuming, but if practicals are always presented as a 'recipe' in which the values of all variables are given, students are unlikely to appreciate the work needed to determine these values. Students could also be given the opportunity to talk to the teacher or technician who prepares their practical activities about the preliminary work involved.

3(c) As mentioned above, identifying and manipulating the independent variable was more straightforward than specifying and measuring the dependent variable. However, many students did select a suitable dependent variable and clearly had an appropriate method in mind, the vast majority planning to test for the continued presence of starch using iodine. Unfortunately it was common for students to forget to include either starch or amylase in their reaction mixture, meaning that the method would not actually work. It should be noted that knowledge of the iodine, Benedict's or Fehling's test is not required by the specification and full credit could be

gained without these, but they are mentioned in the mark scheme to reward those students who were familiar with these tests and could apply them appropriately. It was pleasing to see many students taking great care to describe control of extraneous variables, clearly very well aware of the significance of this issue. However, in some cases this became a catalogue of variables with rather tenuous links to the proposed method, and sometimes variables were simply monitored when they could (and should) have been actively controlled. Students are encouraged to think about the most relevant and important variables to their method (as mentioned in the heading of part c), and to take steps to control these wherever feasible.

3(d) Most students appeared well-prepared for this question and made sure to include a table, calculation of means, graph and statistical test. In some cases students were not sure what to measure as the dependent variable or how to measure it, and therefore the data table was not clear. However, graphs were largely successful because the majority of students correctly identified the independent variable and therefore selection of a bar graph with parts of the plant as the x-axis was quite straightforward. Unusually, students seemed to be more confident in selecting the appropriate type of graph here than they were in Q2(d); often in the past this has been the other way round. Students continue to find it challenging to identify an appropriate statistical test to apply to their data; it was fairly common for mark points 1, 2 and 3 to be awarded for an excellent answer, but for an unsuitable statistical test to prevent the award of mark point 4.

3(e) Students show some awareness of the limitations of experimental methods, with mark points 1 and 6 most commonly awarded, followed by mark point 2. There remains a tendency towards the more generally applicable limitations; mark points 3 – 5 were more specific to the investigation in question and much less frequently seen. However, many students in fact knew, for example, that various parts of the plant contain starch – sometimes using this as the source of starch when planning their investigation – but they did not mention this as a limitation. It would be nice to see more students suggest limitations drawn directly from their experimental methods, rather than relying only on references to uncontrolled variables and genetic variability of organisms.

Advice for students

- Make sure you have carried out all the core practicals, so you understand how they work and have experience of their limitations.
- Think about the purpose and role of each practical technique: what does it measure and under what circumstances can it be used?
- Read each question carefully and answer what is actually being asked.
- Take note of key words such as precise, accurate, valid and reliable – and make sure you know the difference between them.
- Ensure your answer relates to the context of the question and is specific to the practical technique used.
- Look at past papers and mark schemes to become familiar with the format of the exam and the types of answers expected, but do not try to re-use a previous mark scheme when answering a question.
- Discuss preliminary practical work with your teacher. When you carry out a practical, think about the quanitites, times, temperatures and concentrations you are told to use: how were these determined?

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:
http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx

Pearson Education Limited. Registered company number 872828
with its registered office at Edinburgh Gate, Harlow, Essex CM20 2JE