# Examiners' Report/ Principal Examiner Feedback

# January 2016

## Pearson Edexcel International IAL in Biology (WBI06) Paper 01 – Practical Biology & Investigative Skills

https://xtremepape.rs/

**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 2016
Publications Code IA043018*
All the material in this publication is copyright
© Pearson Education Ltd 2016

https://xtremepape.rs/

## Overall Impressions

Students' responses to this paper varied immensely in quality. There was pleasing evidence of students reflecting on the practical contexts provided and thinking independently, demonstrating logical application of biological principles. In general students showed good knowledge of the Core Practical procedures, and the importance of controlling variables is clearly appreciated. Students were also very competent at interpreting the results of the statistical test and identifying safety hazards. On the other hand, some students found it very challenging to engage with the contexts of the questions. Sadly there continue to be students who attempt to apply answers from previous mark schemes to this year's questions, with very limited success.

## Question 1

This question was based around the mitosis root tip squash Core Practical. Students showed very variable levels of understanding of the fundamentals of the technique. Some students clearly appreciated the idea that the squash provides a 'snapshot' of the state of the cells at one point in time. Unfortunately other students seemed to think that the cells would continue their activities under the microscope, so described the cells moving through the stages of mitosis and suggested that the length of the stages could be measured in real time using a stopwatch. It is strongly recommended that students are given the opportunity to carry out all the Core Practicals for themselves, to avoid misconceptions that may arise from a purely theoretical study of the techniques.

## Q01(a)

In general students gave good descriptions of how a root tip squash should be prepared. It was pleasing to see answers from students who were able to explain the reasons for each step of the procedure, although these were not required in this 'describe' question. However, many students did not go on to describe how the squash would be **used** (the second part of the question) and therefore could not access all the marks available. The key ideas here were that the chromosomes would be stained and therefore visible under the microscope, and that the position of the chromosomes indicates the stage of mitosis of each cell.

In some cases practical details were rather vague. Reference to squashing the root tip, without further elaboration, was not sufficient to gain a mark since the term 'squash' is used in the name of the technique. There was some confusion as to appropriate use of slides and cover slips, and some candidates suggested using an electron microscope but this is not suitable for viewing a field of cells

## Q01(b)

This question asked about variables that should be controlled with respect to the **pieces of plant tissue**. Students are reminded that they should take care to read the whole question before answering, since some responses referred to aspects of the procedure for preparing the squash; these answers could not earn marks since they were not what the question asked for. Some answers were too

https://xtremepape.rs/

vague to be credited, for example 'temperature' or 'water' alone; however, these were valid suggestions if related to the context of the question, for example 'temperature at which the plants were grown' or 'water availability to the growing plant'. The idea of controlling the size of the piece of root tissue was a fairly common student answer. Unfortunately this was not relevant to the method in question since the **proportion** of cells at each stage of mitosis is found, so the total number of cells viewed is not important.

In the second part of the question many successful answers discussed the effect of temperature, mineral ion availability or the age of the plant, drawing on familiar biological principles. However, good application of scientific logic was credited in relation to any variable chosen.

**Q01(c)**

There were some excellent answers to this question, often including the mathematical formula that would be used (although this was not required). Other students did not mention that the total number of cells counted was important, but still accessed mark point 3 by making the link between the number of cells at a particular stage and the length of that stage. Sadly a significant number of answers suggested that the stages could be observed in action and directly timed using a stopwatch. Responses based on this idea could not gain any credit, and raised a question as to whether the students concerned had actually carried out the Core Practical.

**Q01(d)**

In general students found this a challenging question. It was common for answers to display confusion as to which events occur at which stage of mitosis. A particularly frequent mistake was the suggestion that prophase would take longer because DNA replication would take longer with a greater number of chromosomes; although this is a logical suggestion, it could not be credited since DNA replication does not take place in prophase. Other students demonstrated good knowledge of the events of prophase, but did not use this to answer the question (often simply listing the events). Mark point 1 was by far the most frequently awarded.

**Question 2**

The context of this question seemed to spark students' interest, stimulating considered critical comments that demonstrated engagement and independent thought. A few moments' consideration was needed for students to identify the correct independent and dependent variables, and it was important that these were described correctly throughout the question. In particular it was the **decrease** in time taken to find food that demonstrated learning by the mammals; references to the time taken (without the idea of the decrease) could not be credited.

https://xtremepape.rs/

**Q02(a)**

There were many concise and clearly stated null hypotheses. Some students continue to find it difficult to decide whether the null hypothesis should describe a significant **correlation** or a significant **difference**, as has been mentioned in reports on previous papers. There was also some imprecision in the statement of variables, for example reference to brain 'size' rather than brain **mass**, or the omission of the idea of the **decrease** in time.

**Q02(b)**

Many of the simpler tables seen by the examiners were also the most successful. Students were asked to display only the brain masses and mean decreases in time taken to find food, so a two-column table could gain full marks. No marking penalty was applied if students tabulated more data, but those who included the names of the mammals and the three sets of repeat data sometimes got into a muddle and made mistakes. Each type of data should have a separate column in the table, and headings should be clear enough to be understood by someone who has not read the question stem. It is also important that mean data is given to an appropriate degree of precision. A common mistake was to mix up the data for hamsters and gerbils: this was understandable given the order in which the raw data were listed in the question paper, but this question assesses the handling of data so students were expected to tabulate the data for all the mammals correctly.

**Q02(c)**

The quality of graph-plotting was more variable than in some previous papers, with more high-quality graphs but also more incorrect graph choices seen. Some students plotted a bar graph with the types of mammal on the x-axis, but this was not suitable because the independent variable under investigation was brain mass (not type of mammal). A number of candidates plotted an otherwise excellent graph, but did not scale the y-axis correctly to accommodate range bars so could not be awarded the third mark. In cases where students had made a mistake in the tabulation of the data, full credit was given for a graph that correctly plotted the data from their table.

**Q02(d)**

This question was generally well answered, particularly in relation to the interpretation of the statistical test. Most students obtained the correct critical value, although some used the wrong number of degrees of freedom. Students appeared very confident in comparing the calculated and critical values, and most correctly stated that the null hypothesis should be accepted. Some students did not go on to gain the final mark because they did not state a correct conclusion. The question also signposted that the graph should be used, but relatively few students made reference to their graphs so mark point 1 was least frequently awarded.

https://xtremepape.rs/

**Q02(e)**

Mark points 1 and 5 were most frequently awarded, for the idea of an uncontrolled variable and the problem of small sample size, and students typically scored 1-2 marks on this question. However, it was encouraging to see many more thoughtful answers commenting on, for example, sensory differences between the species or possible variation in brain mass between individuals. Students are reminded that their answer must relate to the context of the question; very vague or generic statements are unlikely to earn marks.

**Question 3**

The practical technique relevant to this investigation was measurement of the permeability of membranes, often carried out using beetroot. The question stem stated that pigmented cells were provided, in order to steer students in the right direction, and most students selected the correct technique. A solution of perforin was also provided, therefore it was not necessary for students to devise a method for isolation of perforin from parasites.

**Q03(a)**

Since the question stem stated that perforin causes the death of plant and animal cells, it was hoped that students would identify perforin as a hazardous substance. Some students did, but it was much more common to see less specific comments relating to the possibility of the substances used causing allergies or irritation. Safety points that related to working with parasites were not credited since a solution of perforin was provided, so there was no need to use parasites as a source of perforin. For the award of the mark relating to ethical issues, students needed to be very clear that there were no ethical issues. Some answers stated that there were no ethical issues but then went on to identify ethical issues, which unfortunately constitutes a contradiction and prevented the award of the mark.

**Q03(b)**

Students continue to find it challenging to suggest appropriate preliminary practical work, but the examiners felt that there was an improvement in the quality of answers this year. The idea of trialling the proposed method continues to be the most frequently awarded mark point, but it was pleasing to see more students appreciating the need to determine various experimental parameters. The idea of finding suitable volumes and concentrations of solutions, suitable conditions for the activity of perforin and a reasonable timescale to see the effects of perforin were the most common suggestions. Surprisingly few candidates referred to finding an appropriate wavelength setting for the colorimeter, despite the fact that the vast majority of candidates made use of a colorimeter in their method.

https://xtremepape.rs/

**Q03(c)**

Almost all students correctly identified the independent variable and it was encouraging to see many well-designed experiments making appropriate use of plant tissue, perforin and inhibitor. Unfortunately a few students added perforin to the tissue before adding inhibitor, which would allow the perforin to begin damaging membranes without the effect of the inhibitor. The examiners were particularly pleased to see a significant number of students appreciating the importance of a control involving tissue and perforin but no inhibitor.

Students showed a good understanding of the need to control variables and employed appropriate techniques to do so. A few students referred to apparatus such as water baths without making it clear that these were being used to control variables: students are encouraged to be explicit about which variables they are controlling and how this is to be done. Most students referred to the use of a colorimeter, but far fewer were specific about what would be measured (transmittance or absorbance) so mark point 7 was not awarded as frequently as had been hoped. There was a tendency for students to omit important practical details such as rinsing the coloured tissue before use, or shaking the solution to ensure the pigment is evenly dispersed.

There was also significant confusion around the dependent variable. It is important that students should know the difference between the true dependent variable and any measurement that may be used as a proxy. In this case the dependent variable under investigation was the activity of perforin, credited via mark point 2, whereas the intensity of colour of the solution was the measurement proxy, credited via mark point 7.

**Q03(d)**

Mark points 1, 2 and 3 were generally well addressed by students. It is important that table headings are sufficiently clear for the reader to understand the contents of the table, and units must be included (where appropriate). In a few cases the data that students proposed to collect would not have been useful in relation to the question given, but the marks for choice of method are in part (c) so these answers were not further penalised. Almost all students were aware of the need to calculate a mean, but in a few answers there was no reference to repeat data from which means could be taken. It is expected that the table will include space for repeat readings. It was pleasing to see most students correctly select a bar graph to allow comparison of the performance of the potential inhibitors. Interestingly, very few students included results from their control in their table and graph, even when a suitable control had been described in the method. This made it less likely that students would access mark point 4, because it was important that students described the use of a statistical test to compare the inhibitor against a control. A number of answers suggested comparing the inhibitors with each other, but this is not particularly useful: the key test of efficacy is comparison against a control (perforin with no inhibitor).

https://xtremepape.rs/

**Q03(e)**

Students should carefully consider the wording of this question: it asks about the limitations of the **method**. Successful answers will therefore make reference to specific aspects of the practical technique. Students clearly appreciate the importance of controlling variables and the associated difficulties; mark point 1 was the most frequently awarded. Unfortunately many answers did not earn any more marks because they did not discuss the limitations of the particular technique used. It is hoped that all students will have carried out an investigation into membrane permeability. This practical typically yields quite variable results, providing a good opportunity for discussion of limitations such as damage to cells when cutting pieces of tissue.

**Advice for students:**

- Read the whole question before you start to answer, and check that your answer covers everything the question asks for.
- Make sure your answer relates to the specific context of the question.
- When studying Core Practicals, think about what the techniques might be used for and the types of scientific question they might help to answer.
- Carry out every Core Practical for yourself, so you understand how it works and any difficulties that might be encountered.
- If you are given the procedure for a practical technique, put yourself in the shoes of the person writing the procedure: how would they have worked out the details (such as volumes, concentrations and times)? They will have used preliminary practical work.
- Consider the strengths and limitations of each Core Practical technique.
- Practice writing null hypotheses for experiments you carry out, even if you will not necessarily be applying a statistical test.

https://xtremepape.rs/