

Examiners' Report/  
Principal Examiner Feedback

Summer 2014

Pearson Edexcel GCS  
in Biology (6BI06) Paper 1A/1B  
Practical Biology and Research

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## **General Comments**

Once again, there was a wide range of investigations submitted for this unit. These varied from basic memory testing to interesting field studies. Many candidates demonstrated a scientifically objective approach to their investigation with evidence of clear progression to A2 level and examiners were able to award high marks in almost all criteria or moderators were able to support high marks awarded by the centre.

However, there remains a significant number of 1A centres where moderators are unable to support marks awarded or 1B centres where examiners are unable to award higher mark ranges. Sadly this has not reduced over time and many of the comments in this report have been repeated in previous reports, guidance documents and support meetings over the past few years.

### **Some common flawed investigations**

Using core practicals in general.

We do try to credit any evidence we see of the candidate's ability to meet the criteria but all unit 6 reports are accompanied by verification sheets confirming that the candidate has carried out the core practicals. All examiners take this to mean that candidates will have been taught the basic practical techniques and therefore details of methods which consist largely of what might reasonably be expected to have been in a practical protocol can be given only minimal credit for individual planning.

#### **1. Clearance zones in bacterial 'lawns'**

This is a very popular option but in their eagerness to follow this core practical common often ignore some basic HSW principles. Mouthwashes, toothpastes and the full range of creams and spices are added on discs or in wells for comparison. In almost all cases the comparison is at best scientifically dubious or at worst meaningless. Almost all the preparations used have multiple ingredients and concentrations which are often difficult to find as manufacturers give limited information and hence there is little scientific reasoning that can be applied to control the main variables or make meaningful comparisons. These are often characterised by meaningless multiple t-tests, in one case a test of 12 different toothpastes with a matrix of more than 25 t-tests! It is worthwhile repeating that cost of the product is not related to biology or any other science. A scientific comparison must obviously control the large majority of variables not introduce more.

## 2. 'Germination' investigations

There were a surprising number of investigations involving sowing a few cress seeds leaving them on a laboratory window sill and then measuring their height with a 30 cm ruler. Often there is not even an accurate definition of 'height' or how this can be measured accurately when most rulers have a gap at the start of the scale. It is very difficult to support more than minimal planning marks for this very simplistic approach. At this level we would expect candidates to have researched;

The problems of measuring 'growth' and understand that the dry mass of seedlings decreases over the first few days after germination.

That growth and germination are not the same thing.

That initial growth depends on mineral ions and respiratory substrates stored in the seed itself, hence many comments about photosynthesis and its biochemistry were not valid.

## 3. Caffeine and heart rate, etc

The examiners have pointed out previously that 'Red Bull' and similar products contain several active compounds, especially taurine and large concentrations of sugars and therefore cannot lead to scientific conclusions about caffeine.

## Planning (c) Trial Investigations

This section of the planning criteria is designed to allow candidates to provide evidence of their individual planning skills rather than seeking to copy some published protocol. It is a key element of HSW. Examiners and moderators are unable to award high marks where trials are very simplistic and that conclusions made about refined methods are not linked to the actual findings of the trial.

Some common examples of weak trials:

- Concluding that a vernier calliper is a more accurate instrument than a 30cm ruler.
- Concluding that more measurements might be made in the actual investigation.
- Pointless application of running means where it obvious the sample number is predetermined.
- Selecting options from a trial because they seem to fit the hypothesis best.

Good trials

The examiners have stressed that a good place to start with trials is the main independent or dependent variable. Obviously the investigation will not be worthwhile unless these are to be controlled and measured reliably.

E.g. Light is a common independent variable in fieldwork and is notoriously difficult to measure reliably. There is no easy answer to this but it does provide an excellent opportunity for candidates to measure in different ways and make an informed judgement from the data they collect. Examiners and moderators have no fixed answer

to this but seek to reward evidence that the candidate has given this some intelligent thought and made reasonable decisions in the circumstances.

In similar work where there are many variables, then there is the opportunity to check a number of variables to discover which show large variations in the sampling area and which do not.

### **Observing (b)**

Once again, examiners and moderators try to apply the criteria to the widest possible range of investigations in the following way.

At this level 'anomalies' are based on rather subjective judgement and therefore the benefit of doubt is always given to candidates in any ambiguous cases. What is important is evidence of the candidate making sensible scientific judgement.

Where there are obvious and clear anomalies that are not identified a maximum of O(b) 0-2 can be awarded.

Where there are no clear anomalies but the candidate makes no comment then a maximum of O(b) 3-6 can be awarded. For a mark of 7-8 some brief reasoning as to why this decision has been made is required.

The examiners accept that in many investigations it is not possible to simply repeat some readings which are judged to be anomalous. Where this is the case, then some action is required along with a brief justification if 7-8 marks are to be awarded. However arbitrarily removing data such as highest and lowest values or because it does not fit expected results shows limited HSW skill.

Candidates do not need to manufacture anomalies as full marks are available as long as there is evidence of their individual thinking.

### **Interpreting & evaluation (b)**

The most important principle here is that the researched biological science is applied to the candidates' own data. Too often there is a reiteration of what is present in R without careful analysis.

A remarkable number of candidates gave very short, or in extreme cases no, clear biological explanation. In some cases this was because there was none, such as in the case of multiple tests. In others it appeared to be simply passed over very superficially. Correlations are a particular weakness where simply because of the nature of the tests even very weak correlations produce significant values. This is often seized upon as 'proof' of something without regard to the data which often show more detailed or interesting patterns over the entire range of values.

It would be helpful to many candidates to avoid any reference to 'proving' and to show that they understand the idea of scientific models and their reliance on 'supporting' evidence.

## **Interpreting & evaluation (c)**

This remains a weak criterion for many. It is particularly disappointing that a majority of candidates do not approach this section in the manner which has been recommended and often do not show significant progression to A2 level.

Examiners and moderators are looking for an evidence-based analytical approach to evaluation. This will vary according to the chosen investigation and the type of data collected but the following might be considered. Vague speculation about what might have gone wrong offers very little at this level.

- Analysis of the data itself. Are there many anomalies? How might these have arisen?
- Is this variability obviously linked to possible random errors?
- Is it likely there may be systematic errors (although these are often difficult to identify)?
- What is the standard deviation? (already calculated in a t-test) What does this show?
- Were trends and patterns consistent over the whole range?
- How big was the sample?
- Is there any evidence that some variable(s) were not under control?
- Why might the correlation not indicate causation? (an obvious problem in many investigations but very rarely discussed despite it being specification material)
- Just exactly what did the data show? How limited is this and how justifiable is it to extrapolate further? E.g. garlic does have antibacterial properties but there are many biological reasons why it is not the answer to antibiotic resistance.

There are further explanations in the Internal Assessment Guide and in previous examiners reports.

## **Communicating (c) (d)**

Despite their experience in Unit 3 there are still a large number of incorrect references and weak evaluations of sources.

Once again we are looking for an objective analytical approach. To show this then more is needed than simply mentioning some trigger words such as 'peer review' or 'citations'. A brief sentence or so is needed to demonstrate the candidate understands the importance of the phrases they use and that they show that they are using this to come to a conclusion. Similarly, statements such as 'I have cross-referenced this with other sources' gain no credit unless it is clear what sources and what information is being discussed.

Candidates should be strongly advised against using question and answer sites where it is not at all clear that the 'answer' comes from anyone with any scientific credibility

especially if they are anonymous. This would appear to demonstrate extreme naivety at this level.

When listing reference sources in a bibliography simple web addresses which do not give essential details are very common. Examiners and moderators cannot be expected to look up web sites. This is particularly true when providing evidence for use of a journal. Many give web addresses without naming the actual journal even when the source was relevant and the name of the journal prominent on the web page.

There are examples of acceptable referencing in the Internal Assessment Guide.

### **Awarding mark ranges and totals**

When deciding a final mark for a single it is important to record a mark range for each sub-section and then consider the most appropriate mark. It is important to ensure that the full range of marks is considered both within each sub-section and whole criteria.

The biggest single factor which causes significant differences between centre and moderated marks is the application of quality judgements. Where the differences are large this is often characterised by the award of higher mark ranges for any evidence that the criterion has been addressed regardless of a consideration of its quality with regards to A2 level. Annotations on record cards in such cases often consist merely of small quotes from the criteria. All examiners and moderators are asked to look carefully at the final totals they award and consider questions such as; does this report match the A2 grade indicated? Is there a fair differential between this and the previous reports I have assessed?

To place this in context it is important to bear in mind that these are difficult criteria and this is reflected in the grade boundaries. If a piece of work is awarded a mark equivalent to an A\* grade then it indicates that it is an exceptional piece of work compared to all A2 candidates and therefore must contain clear evidence to support this view.

### **Further support**

This report makes frequent reference to the Internal Assessment Guide and previous examiners reports. All centres regardless of their selected mode of entry are strongly recommended to check these documents carefully. There is strong evidence that the advice and clarification they contain is not always reflected in internal assessment or in reports submitted for external assessment.

The 'Ask the Expert' service available through the Edexcel biology web pages allows centres to submit individual questions for advice or clarification by a senior examiner. Further courses concerned with the assessment of this unit, both face to face and online, are planned for this Autumn with details again available through the Edexcel web site.

## **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>

