GCSE EXAMINERS' REPORTS

SCIENCE – BIOLOGY

SUMMER 2015
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SCIENCE - BIOLOGY

General Certificate of Secondary Education

Summer 2015

BIOLOGY 1 – Foundation Tier

Principal Examiner: Dr P. Collison

General Introduction

Candidates at both Foundation and Higher Tiers score marks most freely on short answer questions. Most candidates, especially at Foundation Tier are less comfortable at extended writing as was evidenced on these papers, where many candidates often appeared to struggle as a result of poor language skills and an insufficient body of knowledge and understanding necessary to construct a credit worthy answer. It is for these reasons that most candidates at both Foundation Tier and at Higher Tier, often perform poorly on Quality of Written Communication (QWC) questions, which form 10% of the marks available at Foundation tier and 20% at Higher.

All candidates should be encouraged to pay careful attention to the study of diagrams, graphs and tables given in questions, which often provide essential information and substantial clues. Candidates should also be encouraged not to use vague terms such as amount or type when writing in a scientific context. These terms are not generally credited. Rather, candidates should seek, where appropriate, to employ a measurable physical parameter such as area or mass, or a specific qualitative term such as species.

Specific comments:

Q.1 (a) Most candidates scored the mark for defining the term carnivore.

(b) Although many candidates recognised the three factors that would cause a decline in the hedgehog population, a substantial number appeared not to have focused sufficiently on the question, dropping one mark.

Q.2 (a) (i) Very few candidates gave the correct answer (0.5). The range of diameters seen extended to 13.5 (mm).

(ii) The question requires candidates to engage with the diagram and make simple comparisons, noting that over time, the shells had grown larger and that the number of slits had increased. Many candidates scored at least one of the two available marks. However, a substantial proportion of the entry appeared to have been confused, either by the diagram itself, or by the nature of the process of evolution. These candidates asserted that the shells had grown smaller, with fewer slits, thus inverting the process of evolution.
(iii) Many candidates now have a clear understanding that extinction is an absolute event. Failure to score was generally due to vague descriptions such as ‘died/gone/ can’t be found’.

(iv) Very few scored the mark, which requires candidates simply to note that there are no shells in the top layer.

(b) Only a minority of candidates could put a name to a scientist (Darwin or Wallace) who put forward the theory of evolution by natural selection.

Q.3 (a) This question was all about the effects of adding acidic waste to a river. It required an understanding of the pH scale, which many candidates failed to demonstrate.

(i) Very few candidates demonstrated an understanding that a pH greater than 7 is alkaline.

(ii) The question required candidates to refer to the diagram and note that the pH drops at/after the factory discharge. Very few candidates scored this mark. Others seemed to understand the effect of the discharge but gave vague answers such as ‘the pH is low’ or that ‘the water is acidic’.

(b) (i)(ii) The concept of indicator species was not well known. An answer that stated ‘mayfly nymph’ (was the useful indicator) ‘because it is the only one not found in acidic water’ would have scored all three marks. In fact, the mayfly nymph was the least popular suggestion.

Q.4 (a) (i) Most candidates now produce accurately plotted points on a grid, connected by a neat, clean and crisp line through the centre of each plot. Of the four marks available, the one most likely not to have scored was for the label.

(ii) Most candidates interpreted the graph correctly. Some answered in terms of a rate of decay, rather than % decay, indicating that the question had not been read carefully enough.

(iii) This part requires precise use of language. Suggestions such as shape, size and type did not score. Examiners were looking for something quantifiable such as mass, area, age or a reference to the same species of leaf. A substantial proportion of the responses concerned factors other than those to do with the leaves, such as temperature, thus again indicating that the question had not been read carefully enough.

(iv) Most candidates recalled the name of a group of microorganisms.

(v) Mark earning suggestions as to why the leaves decayed more slowly between months 2 and 3 were to do with measurable soil factors such as temperature or moisture. Very many of the responses were too vague such ‘the weather changed’, or ‘it rained a lot’.

(b) It is disappointing that only a very few candidates were able to state the importance of decay for plant growth.
Q.5 (a) A question calling for the sequencing of events or processes from a given list has been a feature of some of the papers in recent years. Candidates generally do quite well on such a question. However, the processes involved in the activity of the nervous system remain challenging to many candidates. Only a very few interpreted the given information correctly and showed their understanding by applying their knowledge to give the five sentences in a logical sequence. A large proportion of the answers appeared to be given at random.

(b) Most candidates correctly named a sense organ but many then failed to score the second mark because they gave an associated sensation (e.g. taste) rather than the stimulus.

Q.6 The topic of the control of blood glucose is now well understood by many candidates at this level of demand.

(a) Almost all identified insulin as a hormone.

(b) It was pleasing that the key terms of pancreas, glucose and glycogen were seen often, and generally with correct spelling (as is required for the latter two terms). This was particularly gratifying as the candidates had to recall the terms without any prompting, as might have been the case previously.

(c) Most candidates scored the marks for diabetes and injection of insulin, though the more vague ‘take’ insulin did not score. Other acceptable suggestions such as low carbohydrate diet or named tablets were seen only rarely.

Q.7 Many candidates at Foundation Tier are able to deal effectively with the mechanics of a genetics cross to complete a Punnett square. However, on this paper, candidates had to apply their knowledge and understanding to the analysis and interpretation of a family tree depicting the inheritance of cystic fibrosis. This challenge proved to be very daunting to all candidates and beyond the competency of most. A few scored one or both of the genotype marks in (a) and (b) but very few could then go on to make any headway in explanation or give the correct probability in (c).

Q.8 (a) Almost all candidates could label the hair, with slightly fewer scoring for the sweat gland.

(b) As was reported in the Chief Examiner’s Report for summer 2013 and again for summer 2014, most candidates at Foundation Tier do not understand the involvement of the skin in body temperature control.

(i) This year, candidates were required to apply their knowledge in the context of body temperature changes during a break in a period of physical activity. Many candidates scored at least one of the two available marks for a skin response to an increase in temperature, most often for sweating (though an unqualified reference to sweat was not credited). There was often confusion and not a little ambiguity about what happens to blood vessels and/or hair during the cooling response. Answers that were not credited included the idea that blood vessels expand/thicken/open, or that hairs become flat.
Q.8  (ii) A few candidates did give a cogent explanation as to how the narrowing of superficial blood vessels helps to reduce heat loss from the body. However, most candidates were very confused. As usual, a large proportion of the explanations asserted that the blood vessels move away from the skin surface or that there was less blood at or near the surface.

Q.9  (a) Most candidates gained at least one of the two available marks for long-term physical damage caused by excessive alcohol consumption – damage to the liver, kidney and brain being among the most common responses.

(b)  (i)(ii) Most candidates gave the correct conclusion that drinking alcohol increases reaction time and that person 2 had the longest reaction time after drinking.

(iii) It was hoped that candidates would apply their knowledge about increased reaction time to the context of the risks of driving a car after drinking. However, many merely restated their answer to (i), without giving an example, such as taking too long to respond to a hazard in the road thus precipitating a car crash.

Q.10 Candidates at Foundation Tier generally lack the ability to score highly on QWC questions, which call for knowledge, understanding and the construction of a sequential account correctly linking the relevant points.

It was hoped that candidates would itemise John’s excesses beyond the GDA and state the health risk attaching to each. The difficulty here was that most candidates only discussed John’s meal as a generality of unhealthy eating, perhaps making an odd linked point, which thus limited the marks available to low band (1-2). Typical answers were those that were too vague, such as ‘John had a high amount of sugar, so would get heart problems’. Similarly, the references to lack of exercise were often simply related to the idea of John ‘not burning off’ fat, or becoming too fat or having heart problems, so could not be regarded positively when assessing this question.
General Introduction

Candidates at both Foundation and Higher Tiers score marks most freely on short answer questions. Most candidates, especially at Foundation Tier are less comfortable at extended writing as was evidenced on these papers, where many candidates often appeared to struggle as a result of poor language skills and an insufficient body of knowledge and understanding necessary to construct a credit worthy answer. It is for these reasons that most candidates at both Foundation Tier and at Higher Tier, often perform poorly on Quality of Written Communication (QWC) questions, which form 10% of the marks available at Foundation tier and 20% at Higher.

All candidates should be encouraged to pay careful attention to the study of diagrams, graphs and tables given in questions, which often provide essential information and substantial clues. Candidates should also be encouraged not to use vague terms such as amount or type when writing in a scientific context. Rather, candidates should seek, where appropriate, to employ a measurable physical parameter such as area or mass, or a specific qualitative term such as species.

Specific Comments

Q.1 Candidates on Higher Tier generally perform well on the mechanics of genetic crosses but often struggle with explanations. On this paper, candidates had to apply their knowledge and understanding to the analysis and interpretation of a family tree depicting the inheritance of cystic fibrosis. Many candidates showed a good understanding of the term genotype and gave the correct response of heterozygous or Nn in both parts (a)(i) and (b)(ii) and went on correctly to identify the probability of 25% in part (c). Difficulties were manifest in the explanations [(a)(ii) and (b)(ii)], which require precise use of the terms dominant/recessive, allele or correct deployment of the symbols N/n in order to explain how each person came to be heterozygous.

Many accounts were vague, incomplete or ambiguous so did not score. Others were spoilt by use of the term gene, which is not appropriate here, given that the discussion centres on the two different forms, or alleles, of a single gene. However, several candidates did score at least one mark in one or both explanations and a few gave excellent, concise accounts in both sections showing outstanding analytical reasoning and literacy.
Q.2  (a) Almost all candidates could label the hair with slightly fewer scoring for the sweat gland.

(b) The inability fully to explain the involvement of the skin in body temperature control (also examined in summer 2013 and 2014) remains a problem.

(i) This year, candidates were required to apply their knowledge in the context of body temperature changes during a break in a period of physical activity. Most candidates were able to score at least one of the two available marks for a skin response to an increase in temperature, most often for sweating (though an unqualified reference to sweat was not credited). There was often confusion and not a little ambiguity about what happens to blood vessels and/or hair during the cooling response. Answers that were not credited included the idea that blood vessels expand/thicken/open, or that hairs become flat.

(ii) Some candidates gave a cogent explanation as to how the narrowing of superficial blood vessels helps to reduce heat loss from the body. However there was also a lot of confusion seen at all levels, including those achieving the very top grade. As usual, many of the explanations asserted that the blood vessels move away from the skin surface, or that the speed of flow is less, or that there is less blood at or near the surface.

Q.3  (a) Most candidates gained at least one of the two available marks for long-term physical damage caused by excessive alcohol consumption – damage to the liver, kidney and brain being among the most common responses.

(b)  (i)(ii) Almost all candidates gave the correct conclusion that drinking alcohol increases reaction time and that person 2 had the longest reaction time after drinking.

(iii) It was hoped that candidates would apply their knowledge about increased reaction time to the context of the risks of driving a car after drinking. However many merely restated their answer to (i), without giving an example, such as taking too long to respond to a hazard in the road thus precipitating a car crash.

Q.4  In order to get beyond low band in QWC questions, candidates have to demonstrate knowledge, understanding and the construction of a sequential account correctly linking the relevant points. It was hoped that candidates would itemise John’s excesses beyond the GDA and state the health risk attaching to each. The difficulty here was that many candidates only discussed John’s meal as a generality of unhealthy eating, perhaps making an odd linked point, which thus limited the marks available to low band (1-2). Several answers were too vague, such as ‘John had a high amount of sugar, so would get heart problems’. Similarly, the idea of John ‘not burning off’ fat, or becoming too fat or having heart problems could not be regarded positively when assessing answers to this question. A few candidates appeared to have been well drilled in how to tackle QWC questions and gave reasoned and linked accounts fulfilling the criteria at least to some degree and so scored well. Concise answers are always to be encouraged. They minimise the risk of making spelling and grammatical errors and of straying into irrelevance. Rambling accounts, often seen, are considered to be poor QWC.
Q.5  (a)  (i) Candidates were asked, in this part, to refer to the diagram showing the heads of ‘Darwin’s Finches’ and make two observations about the beaks. Here, examiners were looking for a reference to variation in size and shape and most candidates scored at least one of these two.

(ii) Very few candidates scored a mark here for relating variation in the beaks to enabling each species to specialize in a different type of food such as seeds, nuts or invertebrates. The most frequent incorrect response was to suggest that some of the birds could get more food than the others.

(b) Credit was given in this part to realistic and practical suggestions about how to mitigate the impact of increasing tourism on the Galapagos Islands. There were many good answers offered here, though some were too vague, such as banning cars, and the idea that tourism should be stopped altogether was deemed to be a step too far.

Q.6 The concept of eutrophication is often tested at High Demand and generally, candidates are able to recall well prepared answers in answer to a straightforward question. In this paper, candidates were asked to apply their knowledge and understanding to a question on eutrophication presented in graph form.

(a)(b) Both these questions are intended to direct the attention of the candidates to some of the key events in the processes involved in eutrophication. Most candidates scored these two marks by correctly identifying the years involved.

(c) Having interpreted the graph correctly in parts (a) and (b), it might be expected that candidates would then go on to display their knowledge further, by stating that during eutrophication, biomass typically increases with the rapid growth of aquatic plants, reaches a peak, then declines. A sketch graph indicating this, with a peak around 1986 would have secured three marks. In practice hardly any candidates produced such a graph, and all possible patterns were seen. Lines that originated and/or ended at zero biomass did not gain credit.

Q.7  (a) Most candidates correctly selected muddy sand as the habitat with the greatest variety of organisms, though a sizeable proportion opted for mud, which supports the greatest total number but least variety.

(b) Most candidates knew that the process of bioaccumulation in food webs results in the greatest concentration of pollutant in the top carnivores, so correctly identified the birds in this case.

(c) (i) Almost all candidates stated that the general trend shown in the graph was downward. However, candidates who ignored the point of the question, giving instead a detailed description of the various peaks and dips within the overall trend, spoiled their answers.

(ii) The percentage calculation from the graph data was relatively benign at this level. It was therefore disappointing that so many candidates failed to score.
Q.7 (c) (iii) This part asks candidates to suggest how the annual growth rings in the clam might be used to produce data for the graph of lead concentration. A simple answer indicating that the concentration of lead could be measured in each (better still every fifth) growth ring would have gained both marks. A few candidates did make both points but the vast majority were thrown by the novel context and presented spurious or vague answers, often to do with differences in the width or colour of the rings, or that scientists could look for the chemicals in the clam.

Q.8 (a) This question asks candidates to suggest how attitudes to genetic modification (GM) might have changed in recent years in the light of the trend of increasing percentage growth of GM crops in the USA. Many candidates scored the mark for noting that people were becoming more positive towards GM, though the idea that the attitude was becoming ‘better’ is not to be encouraged. A common error was a failure to use the comparative, so that answers such as ‘the attitude is positive’ or ‘that the people are happy’, did not score. A large proportion of candidates misread the question and stated that the percentage of GM crops grown had increased.

(b) Candidates dealing with High Demand questions on GM technology are expected to know that the gene for herbicide resistance from another organism is inserted into the DNA of the host plant. Many answers here were very vague, such as ‘put the gene from a resistant plant into the soya plant’ and did not score.

(c) In this part candidates are asked to make three conclusions from the table of data comparing the effects of insects on GM insect resistant cotton plants and non-GM cotton plants. Examiners were looking for significant conclusions from the data and most candidates scored at least two, if not all three of the marks.

Q.9 (a) (i) The concept that variation may be either continuous or discontinuous is a high level topic. When shown photographs of a black turkey and a white turkey, many candidates scored the mark for stating that this had to be discontinuous (variation). However, a large proportion of the candidates appeared to be unfamiliar with the topic and offered no answer or stated phenotype or mutation.

(ii) Only a few candidates suggested that there was no black allele in the white turkeys or that the white allele is recessive. Many answers were to do with a survival disadvantage in the white feathered turkeys meaning they could not breed or that the offspring would be infertile. Candidates who generalised their answers by using the term gene rather than allele also failed to score.

(b) Most candidates correctly interpreted the genetic profile and identified the two turkeys hatched from the same egg in (i) and the two that had the inherited disease in (ii).

To score the second mark in part (ii) candidates had to make the clear statement that it would not be a good idea to clone these two turkeys because all of the clones would have the have the disease and pass it on. Most candidates seemed to understand the principle though only a small proportion expressed the idea unambiguously.
Q.10 There are limited opportunities to test QWC at high level but the nitrogen cycle does provide one such case. Here the candidates are asked to confine their account to the role of soil micro-organisms in the cycle and to discuss some of the factors affecting their activity.

The quality of written response ranged widely, with many candidates not emerging from low band scores. Many candidates did write good accounts of the cycle yet failed to mention soil factors affecting the microorganisms, so could not gain top band.

However, examiners were pleased to see that there were in fact some excellent answers in which well-prepared candidates clearly understood the processes involved in the nitrogen cycle and had the communication skills necessary to select relevant points and produce a sequential, linked account. The most rewarding answers to read were those that were crisp and concise.
General Comments

Some of the questions on this paper have complicated diagrams or charts associated with them. Questions 6, 7 and 8 are such examples. The amount of writing required to answer these questions is deliberately restricted. The candidates are meant to spend time looking at the diagrams and charts in an attempt to understand them. The diagram in question 6 needed careful study in order to appreciate the relationship between the four experiments. In this example some of the better candidates added simple annotations to each diagram to gain a better understanding of this relationship. There was no instruction to annotate but those that did demonstrated an important skill.

The diagram in question 7 (b) needed careful observation in order to gain an understanding of what was happening in each of the test tubes. Again better candidates added simple annotations, which clearly demonstrated understanding.

The chart in question 8 (b) required very careful observation in order to correctly perform the calculations for parts (i) and (ii).

It is clear from many of the answers to questions 6, 7 and 8 that candidates do not spend enough time studying and trying to understand the information and detail in diagrams and charts. Developing this skill would reward candidates with a higher overall mark for the paper.

Also on this paper candidates were asked to do some drawing. A line graph in question 5 (b), to copy two simple shapes in question 7 (a) (i) and to shade in the pits on a spotting tile in question 7 (b). Some candidates performed very well in these tasks but others failed to gain the marks that they perhaps deserved because they attempted the exercise using ink/biro. The issue here is an obvious one. They make an error, which they then attempt to correct – in ink. Quite often the original error and the correction so obscure the answer that the candidate is attempting to provide that the examiner cannot award the marks. The solution to this problem is a simple one – candidates should draw all diagrams and graphs in pencil and ensure that they have an eraser with them. This simple instruction would ensure that some candidates increase their overall mark.
Specific comments

Q.1  (a) (i) Candidates generally performed well on this question. Errors included cell membrane for cell wall and chlorophyll for chloroplast.

(ii) Few gained 2 marks here. Candidates found identification of the cells difficult.

(b) (i) Generally well answered

(ii) Many candidates failed to gain the mark here. These candidates often stated that a virus was made up of only one cell rather than stating that a virus is not a cell.

(iii) Generally well answered although many candidates reversed the answers.

Q.2  (a) Both parts were generally well answered.

(b) Generally well answered although many reversed the answers.

Q.3  (a) Most candidates gained 2 or 3 marks here. Nitrogen was often incorrectly given as the waste product of aerobic respiration yet many of these same candidates identified carbon dioxide correctly in part (b).

(b) Most candidates knew the positive test for carbon dioxide and gained both marks.

Q.4  (a) Most gained this mark.

(b) (i) Most found this difficult. Examiners looked for answers relating to the loss of nectar, food, nest sites or habitat.

(ii) Many gained the 2 marks available for this calculation. A common incorrect answer was 30 000. If the answer given was incorrect then examiners looked at the working to see if the correct figures of 480 000 and 180 000 were used in the calculation. If this was the case then 1 mark was awarded.

(iii) Most gained this mark for recognizing the importance of honey.

(c) Candidates found this question difficult mainly because they failed to refer to a decrease in number of species (of solitary bees or wild flowers) in their answer.

Q.5  (a) (i) Most gained at least one of the marks here usually for knowing the harmful effect of cigarette smoke on the action of cilia. Reference to the cilia being killed was not credited. Far too many candidates referred to the cilia as being in the throat or oesophagus. Less well known was the effect cigarette smoke has on the mucus.

(ii) Most gained the mark for tar. The most commonly seen incorrect answer was nicotine.
(b) (i) I. Most gained the scale mark. Where the scale mark was lost it was for placing zero 1 cm along on the x-axis. This meant that the first plotted point was not placed on the y-axis. In this case the scale mark was not awarded.

II. 2 marks were awarded if all the plotted points were correct. A tolerance of ± 0.5mm (half a small square) was allowed in plotting the points. If all the plotted points were correct then 2 marks were awarded. If there was 1 error 1 mark was awarded and for more than 1 error 0 marks were awarded. Each plotted point should be shown as small crisp x or •. Often the plotted point is drawn as a very large and dense x or a large dense ‘blob’. In situations like this it becomes very difficult for the examiner to judge whether the plotted point is within tolerance and marks can often be lost.

III. 1 mark was awarded for a single, clean, crisp line, drawn with a ruler, which went through the centre of each plotted point. There was no tolerance allowed here. Some candidates find this difficult and often missed the centre of the plotted points. Any extrapolation of the line past 40 cigarettes/day lost a plotting mark.

(ii) Most candidates gained 1 mark here for stating that an increase in the number of cigarettes smoked/day resulted in an increase in the number of deaths from lung cancer. Candidates were expected to refer to the number of deaths and not just the number of cases of lung cancer. The second mark was for recognizing the significant increase in the number of deaths from lung cancer when 20 cigarettes were smoked per day. Very few candidates gained this mark.

(iii) To gain the mark candidates had to take the reading from their graph. Quite often the mark was lost because the line went through 61 deaths but the answer given by the candidate was 60. No tolerance was allowed here. Here, a neat, crisply drawn line helped the candidate take the correct reading.

(iv) Many candidates recognized that when 0 cigarettes were smoked per day there were still deaths from lung cancer. Some candidates read this as 0 people smoking and lost the mark.

(c) The answer here needed to make reference to the dangers of passive smoking, second hand smoke or secondary smoking. Far too many candidates lost this mark for statements such as ‘inhaling smoke is harmful’. In this sort of answer it is unclear as to whether the candidate is referring to the smoker or someone inhaling second hand smoke.
Q.6  (a) Most gained at least one mark and many gained both. A common incorrect response was to reverse the answers or to include light, chlorophyll or energy as one of the answers.

(b)  (i) Better candidates gained at least 1 of the marks available in the table but most found this difficult. Some candidates added additional notes to the diagrams such as for **Experiment D – no light and no carbon dioxide**. This often helped the candidates to come up with the correct answers in the table.

(ii) Again many found this difficult. Candidates who had obviously spent time studying and trying to understand the diagrams often gained both marks.

Q.7  (a) (i) Most candidates gained 1 mark for drawing the simple molecules inside the active site of the enzyme. The second mark they found more difficult to obtain. This was awarded for any attempt to connect, or draw a connection between, the 2 simple molecules. Very few gained this mark.

(ii) Better candidates knew the Lock & Key Model. Enzyme-substrate complex was frequently seen as an answer but was not accepted as a model of enzyme action.

(iii) Many candidates knew that boiling denatures enzymes and gained the 1st mark. Fewer candidates gained the 2nd mark by going on to say that this meant that the simple molecules would no longer fit into the active site of the enzyme.

Far too many candidates referred to the optimum temperature of an enzyme and how going above (or below!) the optimum temperature denatured the enzyme. The question clearly referred to boiling and no other temperature.

(b) Those candidates who understood the iodine test for starch, read the question carefully and studied the contents of the 3 test tubes, often scored well in this question. They realized that both glucose and enzyme were required to produce starch, i.e. Test tube 1 and that the other 2 tubes could not possibly produce starch.

Every possible combination of shading was seen on the spotting tile. Some candidates attempted to use coloured inks (usually black for starch and red for iodine) to depict the contents of the spotting tile and often ended up with an unintelligible mess and lost marks. (See introduction).
Q.8  
(a) Better candidates gained this mark. Spelling was important here. Phonetic spelling was credited so that for example, *bronciole* and *bronchiol* were accepted. However any word which could confused bronchus/bronchi and bronchiole was not accepted, e.g. *broncholi*.

(b) (i) Better candidates gained this mark. Far too many candidates failed to study the x-axis carefully enough and took their reading at 64 seconds.

(ii) Many candidates struggled with this calculation because they took their readings from the origin of the y-axis i.e. their calculation was $5.0 - 3.6 = 1.4 \text{ l}$. If candidates used the correct readings (3.0 & 0.6) but arrived at the wrong answer 1 mark was awarded. In order to gain 2 marks for the correct answer the unit was required. No mark was awarded for the unit so that 1.4 l gained no marks.

Q.9  
Generally the performance here was limited. Most foundation candidates gained marks in the lower band. Occasionally candidates scored 3 or very rarely 4 marks. Candidates are expected to have carried out this experiment or at least have seen it demonstrated.

The specification statement that this question attempts to address is 4. (b) *Investigate experimentally energy release as heat during respiration, by germinating peas, including the role of thermos flasks and disinfectants.*

The main issues that the candidates experienced, which limit the mark obtained, were:

- **Sequencing** – the account must indicate that the apparatus has been set up in the correct order. For example, the peas should be disinfected before being placed in the thermos flasks. Many candidates place the peas in the flasks and then pour disinfectant on them.
- **Vagueness** – the cotton wool should be used to close the neck of the flask. Many candidates refer to the wrapping of the flasks in cotton wool or placing the peas on a ‘soft bed’ of cotton wool.
- **Failure to read the question** – candidates are told in the question that they must include a suitable control. The vast majority of the candidates failed to refer to a control in any way. Those candidates who did make reference to a control often made statements such as ‘I will take control of the experiment’ or ‘I will control how I set up the apparatus’. There was no understanding of the use of, or purpose, of an experimental control. Reference to the control was essential in order to take the candidates’ account into the top band.
- **They are told in the apparatus list that there are 2 Thermos flasks. Some candidates included a 3rd flask with an odd combination of living and dead peas**
- **Lack of understanding** – some candidates only disinfected the living peas because they wanted bacteria to grow on the dead peas so that it could be demonstrated that bacteria produce heat. Some candidates placed 1 pea in each flask. Some placed the flasks in bright sunlight so that the peas could photosynthesise whilst others placed them in the dark.
- **Lack of precision** – most referred to placing the thermometers in the flasks but very few candidates placed the bulb of the thermometer in the centre of the peas. Often the thermometers were *removed* to ‘read the heat on the scale’. Answers were often vague about when the temperature readings should be taken and how they should be compared between the 2 flasks.
- **Presentation** – many candidates are let down by very poor spelling which restricts the band that the answer can be placed in. Grammar is often poor as is the quality of the handwriting which is often very difficult to read.
General comments

Some of the questions on this paper have complicated diagrams or charts associated with them. Questions 1, 2 and 3 are such examples. The amount of writing required to answer these questions is deliberately restricted. The candidates are meant to spend time looking at the diagrams and charts in an attempt to understand them. The diagram in question 1 needs careful study in order to appreciate the relationship between the four experiments. In this example some of the better candidates added simple annotations to each diagram to gain a better understanding of this relationship. There was no instruction to annotate but those that did demonstrated an important skill.

The diagram in question 2 (b) needed careful observation in order to gain an understanding of what was happening in each of the test tubes. Again better candidates added simple annotations, which clearly demonstrated understanding.

The chart in question 3 (b) required very careful observation in order to correctly perform the calculations for parts (i) and (ii).

It is clear from many of the answers to questions 1, 2 and 3 that some candidates do not spend enough time studying and trying to understand the information and detail in diagrams and charts. Developing this skill would reward candidates with a higher overall mark for the paper.

Also on this paper, candidates were asked to do some drawing. To copy two simple shapes in question 2 (a) (i) and to shade in the pits on a spotting tile in question 2 (b). Some candidates performed very well in these tasks but others failed to gain the marks that they perhaps deserved because they attempted the exercise using ink/biro. The issue here is an obvious one. They make an error, which they then attempt to correct – in ink. Quite often the original error and the correction so obscure the answer that the candidate is attempting to provide that the examiner cannot award the marks. The solution to this problem is a simple one – candidates should draw all diagrams and graphs in pencil and ensure that they have an eraser with them. This simple instruction would ensure that some candidates increase their overall mark.
Specific Comments

Q.1 (a) Generally well answered
(b) (i) Most candidates gained at least 1 of the marks available in the table but many found this difficult. Some candidates added additional notes to the diagrams such as for Experiment D – no light and no carbon dioxide. This often helped the candidates to come up with the correct answers in the table.
(ii) I Most gained this mark.
II Better candidates gained this mark although many experienced difficulty. A and D was a commonly seen incorrect answer. This was difficult to understand as both A and D have light excluded.

Q.2 (a) (i) Most candidates gained 1 mark for drawing the simple molecules inside the active site of the enzyme. The second mark they found more difficult to obtain. This was awarded for any attempt to connect, or draw a connection between, the 2 simple molecules. Very few gained this mark.
(ii) Most candidates knew the Lock & Key Model. Enzyme-substrate complex was frequently seen as an answer but was not accepted as a model of enzyme action.
(iii) Most candidates knew that boiling denatures enzymes and gained the 1st mark. Fewer candidates gained the 2nd mark by going on to say that this meant that the simple molecules would no longer fit into the active site of the enzyme. A few candidates referred to enzymes being denatured above the optimum temperature. This usually led to confused answers and loss of the mark.
(b) Those candidates who understood the iodine test for starch, read the question carefully and studied the contents of the 3 test tubes, often scored well in this question. They realized that both glucose and enzyme were required to produce starch i.e. Test tube 1 and that the other 2 tubes could not possibly produce starch.

Every possible combination of shading was seen on the spotting tile.

Q.3 (a) Better candidates gained this mark. Spelling was important here. Phonetic spelling was credited so that for example, bronciole and bronchial were accepted. However any word which could confuse bronchus/bronchi and bronchiole was not accepted, e.g. broncholi.
(b) (i) Most candidates gained this mark. Some candidates failed to study the x-axis carefully enough and took their reading at 64 seconds.
(ii) Many candidates struggled with this calculation because they took their readings from the origin of the y-axis i.e. their calculation was 5.0 - 3.6 = 1.4 l.

If candidates used the correct readings (3.0 & 0.6) but arrived at the wrong answer 1 mark was awarded. In order to gain 2 marks for the correct answer the unit was required. No mark was awarded for the unit so that 1.4 l gained no marks.
Q.4 Far too many candidates scored in the lower and middle bands. Better candidates scored 5 or 6 marks.

Candidates are expected to have carried out this experiment or at least have seen it demonstrated.

The specification statement that this question attempts to address is 4. (b) Investigate experimentally energy release as heat during respiration, by germinating peas, including the role of thermos flasks and disinfectants.

The main issues that the candidates experienced, which limit the mark obtained, were:

- **Sequencing** – the account must indicate that the apparatus has been set up in the correct order. For example, the peas should be disinfected before being placed in the thermos flasks. Many candidates place the peas in the flasks and then pour disinfectant on them.
- **Vagueness** – the cotton wool should be used to close the neck of the flask. Many candidates refer to the wrapping of the flasks in cotton wool. Or the placing of the peas on a bed of cotton wool.
- **Failure to read the question** – candidates are told in the question that they must include a suitable control. The vast majority of the candidates failed to refer to a control in any way. Reference to the control was essential in order to take the candidates' account into the top band.
- **Lack of precision** – most referred to placing the thermometers in the flasks but very few candidates placed the bulb of the thermometer in the centre of the peas. Many candidates failed to state when the temperature should be taken.
- **Presentation** – some candidates are let down by very poor spelling which restricts the band that the answer can be placed in. Grammar is often poor as is the quality of the handwriting, which is often very difficult to read.

Q.5 (a) Most candidates knew peristalsis but the spelling was often questionable. Phonetic spelling was credited.

(b) (i) Most candidates answered that the mass of the undigested food increased between pH3 and pH4. The difficulty some candidates experienced was in explaining what happened to the mass between pH4 and pH6. In order to gain both marks pH5 had to be identified somewhere in the account as either the point where the increase in mass stopped or the as the point where the mass undigested levelled off.

(ii) Better candidates answered pH3 but far too many incorrectly answered pH5.

(iii) Generally well answered although far too many candidates could not link the acid pH with digestion of protein in the stomach.

Q.6 (a) (i) Most gained two marks for drawing the bases.

(ii) Most knew the names of the 4 bases and gained both marks. Where marks were lost it was for incorrect spelling.

(b) Most found this difficult. Better candidates knew that 3 bases form a code but only the best candidates could explain how the code was responsible for the sequencing of the amino acids.
Q.7  (a)  (i)  Generally well answered.

(ii)  Well answered.

(iii)  Some found this difficult. They needed to know that aerobic respiration releases the most energy per glucose molecule and then they had to work out when **most** aerobic respiration was occurring. Far too many candidates choose a time other than 0 – 2 minutes and lost both marks. The 1\textsuperscript{st} mark was gained for stating the correct time and the 2\textsuperscript{nd} mark for stating that that was when most aerobic respiration occurred. The 2\textsuperscript{nd} mark was dependent on the 1\textsuperscript{st} mark being gained.

(b)  Well known although red blood cell was an occasionally seen incorrect answer.

Q.8  (a)  Better candidates gained the mark although there was some confusion between active transport, diffusion and, surprisingly, osmosis.

(b)  Most found this difficult particularly if they failed to answer active transport in (a). Most candidates failed to link digging the soil with an increased availability of oxygen (1\textsuperscript{st} mark) and then an increase in the active transport of nitrate because of an increase in respiration (2\textsuperscript{nd} mark). The 2\textsuperscript{nd} mark was dependent on the 1\textsuperscript{st} mark being gained.

(c)  Many candidates gained all 3 marks. The knowledge and understanding of osmosis is always very good. For the 1\textsuperscript{st} mark candidates needed to make it very clear that water was moving from a high concentration of **water** to a low concentration of **water**. To state that water passes from a high concentration to a low concentration was not enough to gain the mark. The 2\textsuperscript{nd} mark was awarded for reference to the selectively permeable membrane and the 3\textsuperscript{rd} for stating where the high and low concentrations of water were.

Q.9  (a)  (i)  Poorly answered. Transect was not well known. Spelling of transect needed to be correct.

(ii)  Some gained 1 mark but few candidates gained both marks. Examiners were looking for quadrat (correct spelling) and tape measure or rope marked at meter intervals. ‘Square grid’ was not acceptable for quadrat neither was ruler/meter stick for tape measure.

(b)  Most gained 2 marks here.

(c)  Most candidates found this difficult. The term competition was rarely seen. Incorrect answers such as the parent plant takes all the sun or light or even food, were common. Examiners were looking for answers which stated that there is less light/water/minerals etc. available because of more competition from the parent plants.

Q.10  Far too many candidates gained marks in the bottom band. Only the very best candidates gained a 5 or 6. Although it doesn’t seem as if the answer to this question requires sequencing parts of it certainly do.

The account should start off with the smoke being inhaled and the effect this has on the cilia and mucus. Harm caused here can result in mucus travelling deep in the lungs causing irritation, coughing and possibly emphysema with its resultant shortness of breath. Carcinogens in cigarette smoke should then be discussed and finally the change in attitudes to smoking. It is not enough to state, for example, that smoke can harm your lungs or that smoking ‘clogs the lungs’ – detail is required and this is what many accounts lacked. Many accounts discussed the change in attitudes to smoking but omitted any information on the harmful effects of smoking.
General comments

The more able students tend to be entered for the separate sciences. Evidence for this is apparent in their performance on the more demanding questions in both Foundation and Higher tiers. It was pleasing to see some very good answers to the questions which assessed the quality of written communication in the higher tier. However, the same question on the common section still proves to be a massive hurdle to foundation candidates. Many scored zero and a significant number failed to attempt the question. Once again, those who had experienced practical work on incubating bacterial cultures using a sterile technique were at an advantage. Those who had not seen the process in a laboratory lost the majority of marks for this question.

Another observation was the general poor performance on the questions requiring knowledge and understanding of plant biology. This was particularly true in questions 1 and 6 on the foundation paper but it was also seen in the higher paper in response to questions 1 and 6. It seems that most candidates prefer to learn material concerning human biology rather than plant biology. Complete coverage of the specifications will always be the aim of the assessment.

Specific comments

Q.1 Most did not know the facts for answers to parts (a) – (c). In order to gain the mark for (c), candidates had to understand that stomata control or regulate water loss or allow gaseous exchange.

Q.2 Most gained marks for (a) (i) and (ii). In part (iii) the minority knew the term, systemic circulation. Marks were often lost in (b) for not recognising capillaries. Some suggested that capillaries have thin cell walls. The minority linked diffusion with the thin walls of the capillaries.

Q.3 (a) Almost all candidates gained two out of three marks for the graph and also gained the mark for the simple calculation in part (b).

(b) Most gained the mark for the simple calculation here.

(c) It was pleasing to see so many correct answers to the calculations involving data from the graph but there were vague answers to (c) (iii). Few recognised that person 1’s heart rate returned to normal in a shorter time.

(d) "How science works" in an investigation was assessed and again it was pleasing to see many correct answers showing an understanding of the need for repetition in (i). Fewer candidates saw the need for the subjects to be of the same age in part (ii).
Q.4 Knowledge of the basic facts relating to the excretory system was beyond those who had not prepared via thorough revision. In order to gain the mark for (b) (ii), candidates had to state that the concentration of urine increases when there is too little water in the blood.

Q.5 This straightforward comprehension exercise proved to be accessible to the majority. Those who are correctly entered for the Foundation tier mostly achieved positively on this type of question. Most gained at least half the available marks. In (b) credit was given for the product being ethanol or carbon dioxide as an answer to the question.

Q.6 The ability to recall facts about nutritional deficiencies was lacking in the majority. Most recognised the need for fertiliser as an answer to part (b).

Q.7 (a) In order to overcome any ambiguity, the labels sclera or optic nerve gained credit for B on the diagram. Both labels, A and B, had to be correctly spelled or spelled phonetically.

(b) Many candidates gave incomplete or inaccurate explanations of the appearance of the eye in different light intensities. The roles of the iris and the pupil should have been included in the answer. Many failed to identify that diagram 1 showed the appearance in dim light. Very few candidates gained more than half the available marks.

Q.8 Those who had seen an aseptic technique being demonstrated in a laboratory gained high marks. They were able to gain the first mark by underlining the correct sequence horizontally or by underlining each letter in the sequence vertically. Hardly any gained the mark in (b) (iii) for stating that failure to sterilise the inoculating loop allowed bacteria, other than those in milk, to survive.

Q.9 The combination of two high order skills or re-calling a sequence of facts and expressing them in continuous prose proved to be too difficult for the vast majority. Many zero scores were recorded. Some recognised the function of platelets in clotting but could not describe the roles of various types of lymphocytes.
General comments

The more able students tend to be entered for the separate sciences. Evidence for this is apparent in their performance on the more demanding questions in both Foundation and Higher tiers. It was pleasing to see some very good answers to the questions which assessed the quality of written communication in the higher tier. However, the same question on the common section still proves to be a massive hurdle to foundation candidates. Many scored zero and a significant number failed to attempt the question. Once again, those who had experienced practical work on incubating bacterial cultures using a sterile technique were at an advantage. Those who had not seen the process in a laboratory lost the majority of marks for this question. Another observation was the general poor performance on the questions requiring knowledge and understanding of plant biology. This was particularly true in questions 1 and 6 on the foundation paper but it was also seen in the higher paper in response to questions 1 and 6. It seems that most candidates prefer to learn material concerning human biology rather than plant biology. Complete coverage of the specifications will always be the aim of the assessment.

Specific comments

Q.1  As expected, the standard of the answers to the questions common to both papers was much better on the higher paper than on the foundation paper. Those who had been correctly entered for the higher paper were more likely to have learned facts than those entered for the foundation paper.

Q.2  (a) Labels were given credit if they were correctly spelled or spelled phonetically. Label B was credited as sclera or optic nerve.

(b)  It was pleasing to see many correct answers. The majority gained some marks and those who took time to read the question thoroughly gained the marks for explaining the roles of both the pupil and the iris in adjusting to different conditions of light.

Q.3  Most found this question to be relatively easy and gained the first marks. Credit was given if the correct sequence was underlined horizontally or if the correct sequence of separate letters were underlined vertically. However, the consequences of eliminating stage B in the diagram were often not stated clearly. If the loop is sterilised, then the bacteria on the agar could only have come from the milk.

Q.4  There were some excellent accounts written by those who had correctly been entered for the higher tier. Unfortunately some centres are entering candidates who would be better suited to the foundation tier. Their performances on this question were only worthy of the lower band or even zero.
Q.5 This was the first of the exclusively higher questions. The labels in (a) were usually correct but answers to part (b) were very disappointing. The idea of oxygenated blood mixing with deoxygenated blood was often understood but the consequences of this problem were not known by the majority. A vague statement such as "the body is only getting deoxygenated blood" was common. Also, candidates tended to miss out the fact that the blood from the left ventricle could pass into the right ventricle.

Q.6 As a higher demand questions (a) required two functions of the stomata to be given for one mark. Hardly any recognised one function as controlling or regulating water loss and very few mentioned gaseous exchange. Most obtained the mark for (b) and (c) and those who knew the factors regulating transpiration gained marks for (d). Some did not read the question carefully enough and did not consider the time needed for the stomata to open or close.

Q.7 This was a straight forward question requiring knowledge and understanding of the role of ADH. Many completely correct answers were seen but a mark was often lost in (b) for not relating the increase in ADH to an increase in the concentration of urine.

Q.8 Parts (a) (i), (ii) and (b) usually gained marks by candidates who had prepared themselves by learning facts. Parts (a) (ii) and (iv) required an understanding of the way in which a dialysis machine works. Only the better candidates gained marks for recognising the potential problems of blocking the machine with blood clots in part (ii) and the very good ones mentioned the maintenance of a concentration gradient in part (iv).

Q.9 (a) "How science works" in terms of statistical analysis was assessed. Good candidates saw the significance of expressing the data per 100 000 for a meaningful compression. Many succeeded in working out the calculation in (ii) but fewer saw the point of expressing the data on deaths per 100 000 or as a percentage in (iii).

(b) The best candidates did very well on this question. They had learned the role of memory cells and understood the significance of antigens in initiating the primary response to the invasion of pathogens.

(c) It was disappointing to see so many answers that did not clearly link antibiotic resistance and bacteria. Often, incorrect statements about resistance to disease or vaccines were made.

Q.10 A vast difference was noted between the quality of written communication of those who had been correctly entered for this paper and who should have been entered for the foundation tier. Many good candidates gained full marks as they met the published criteria for this type of question. Unfortunately, some otherwise very good candidates failed to gain the higher band because they did not define a reflex action. Therefore they failed to address the question fully.
Overview

In general, the standard of both the candidates' work and the marking was similar to 2013-14. Once again, the research task proved the most challenging for candidates, particularly the second part. The safety task usually generated the highest mark, which is not surprising as it was relatively brief and straightforward.

The standard of centre marking was generally good, and a certain level of tolerance has to be given with any best fit marking scheme. The vast majority of centres whose marking was inaccurate were erring on the side of generosity, especially towards the top end of the mark range. Full marks for any of the skill areas in the assessment are only likely to be achieved by exceptionally able candidates and very high marks were sometimes awarded for work that showed quite a low level of scientific thinking. Centres are recommended to view the exemplar work on the WJEC website to gain an understanding of the standards demanded. There seemed to be a greater degree of consistency of marking within centres this year.

This is not just an issue related to in-house moderation, as in previous years marking was sometimes inconsistent within a teaching group. This year, however, the rank orders submitted by centres were nearly always agreed.

Administration and marking

In general, samples were submitted on time and were well organised. In general, the safety task was the most accurately marked, and the main areas of marker generosity were in the research task. There were a number of instances of clerical errors by centres. These involved incorrect addition of the marks, a mismatch between the marks awarded on the work and on the record card, or the submission of a mark that was different from that on the record card. Moderators can obviously only pick up such errors in the sample and it is important that care is taking when entering marks.

Pupil performance

Overall the standard appeared to be very similar to that shown in previous years. As always, there was some excellent work submitted, but the average candidates still have a weak understanding of some areas of scientific enquiry, most notably in designing investigations and in judging the strength of evidence. Many are still not able to put together a clear, structured and concise scientific report.

RESEARCH TASK – GENERAL ISSUES

This task proves to be difficult as it combines the need for both a good understanding of the methods of scientific enquiry and good communication skills. In this task, the necessary communication skills go further than simple spelling and grammar, although it is obvious that some candidates struggle in these areas. The best work shows a logical structure, an ability to discuss ideas and precise use of language. Some candidates still seem to treat this task as if it was judged on length. Even if they do not include irrelevant material, there is a tendency to ramble.
In part 1, the conclusions and the judgement of strength of evidence are the main problem areas. Information from references is presented with little discussion of its worth, apart from an occasional reference to possible bias or to it being from a reputable source. There is little consideration of whether the information is likely to have been through a peer review process (e.g. if published in a scientific journal) or of things like sample sizes, possible difficulties with controls or whether the work has been replicated by other researchers.

In a typical piece of work the evidence was often presented and then, at the end, a simple conclusion was drawn along the lines of "In considering the evidence I have decided that......." with no indication of what factors had resulted in that decision. It was quite common for candidates to judge the strength of evidence purely on a count of references on either side. This has some merit, but only if the quality of the evidence is similar – one high quality study could outweigh several mediocre ones.

Part 2 of the research task clearly presents the biggest challenge of the whole portfolio. Candidates frequently tried to design an experiment in a situation (in both packs, this year) which demanded field work. Even the more able candidates struggled to some extent, here.

PRACTICAL TASK – GENERAL ISSUES

Several problems listed in last year’s report were still evident this year. They were as follows:

- Candidates do not seem to understand the relationship between variability and repeats. They still often stick to the ‘standard’ 3 repeats, which would hardly ever be enough in a real research situation. Others seem to apply an approach of ‘the more the better’ which is not always either necessary or practical.

- Some candidates erroneously believe that doing more repeats improves repeatability or improves the accuracy of results (as opposed to accuracy of the mean, which is improved). Occasionally, a candidate would state (correctly) that doing repeats allows the identification of anomalous results. However, in such a situation, doing just three repeats would give extremely limited evidence for any anomaly.

- Many candidates do not really understand the concept of outliers or anomalous results. They often use the term to refer to results that are unexpected, rather than anomalous. In particular, we saw examples of ‘anomalous’ points that were means. This should rarely happen. If the repeatability of the data set is good, the point is unlikely to be anomalous. If the mean is the result of one anomalous result within the dataset, that result should have been ignored when calculating the mean. Another fault was to pick one result as anomalous when, due to limitations in the number of data points, there were several possibilities depending on where the line of best fit was drawn.

SAFETY TASK – GENERAL ISSUES

In both packs this task generally produced the best performances and the highest marks, and the quality of the risk assessments is gradually improving. Hazards were sometimes identified without stating their nature. Candidates did not consider the precise risks brought about by the method used or did not identify which parts of the method were likely to lead to these risks, and how.

It is important to clarify the issue of repeats in the safety task. The clips merely show the technique used, not a whole study, so it should not be assumed that the experiment will not be repeated. The suggestion of doing more repeats as an improvement to the technique is not therefore creditworthy, and should be treated as neutral. However, it is relevant to state that the absence of repeat data is a weakness in the strength of evidence as it stands.
PACK A - RESEARCH TASK

PART 1

Most candidates produced reports that contained only relevant material, although sometimes too few sources were used, meaning that some relevant material was missed out. On occasions, candidates produced, in effect, an essay on global warming which did not specifically focus on the role of human activities. The main problem was a lack of any personal involvement in the debate. The evidence was presented without discussion and then a brief conclusion was added at the end, without any detailed explanation of the grounds for that particular conclusion. Considering the vast amount of material available on global warming, it was disappointing that so many candidates more or less restricted their account to the sources given.

PART 2

This was poorly done. The main problems were:

- Many accounts were very vague. Candidates were not expected to know about the exact methodology of measuring carbon dioxide, but many plans lacked any detail about variable factors (e.g. level of activity, prevailing winds, time of day and year, height above ground, plant cover, nearby industry etc.)
- Some candidates did not mention how many volcanoes they would use in the work, or simply decided to study one. We were tolerant regarding sample size, as many ‘active’ volcanoes have not erupted for centuries.
- It is clearly impossible, in the circumstances, to fully control all variables. Candidates should therefore have considered how to take account of such variability in the processing of their results, but accounts of processing were often limited to stating that a graph would be drawn.

PACK A - PRACTICAL TASK

PART 1

Candidates coped with the task quite well, as it was simple and straightforward. The analysis tended to be rather superficial. The hypothesis was incorrect, and the results generally showed that. However, some candidates failed to pick up on the fact that the evidence collected was unlikely to be sufficient to draw any firm conclusion, given that very few people were tested, and they would have been within an extremely narrow age range. There was an opportunity here to make use of class results in greater depth than was evident. It is acceptable to say that other groups’ results also showed differences in sensitivity, but often no comment was made about whether these other results showed the same areas being more or less sensitive. If they did, this is useful evidence, if they did not, then the reliability of the test is thrown into doubt. There was rarely any comment on the scale of the difference in sensitivity, another factor that could have been used to consider strength of evidence.

PART 2

Most candidates produced adequate experimental designs, although quite a lot did not actually test the effect of temperature, but merely compared ‘hot’ to ‘cold’.

PACK A - SAFETY TASK

This was a fairly straightforward task, but the risk assessments tended to show the generic faults listed under general issues (above). Relatively few candidates had the knowledge to realise that the results actually contradicted what is known about thermal conductivity in these metals (as copper should have fallen first).
PACK B - RESEARCH TASK
PART 1

Once again, as with pack A, the main fault was a lack of consideration of the evidence. Most candidates simply reported it and then drew a conclusion which did not use the evidence to justify it.

PART 2

As mentioned in the ‘general issues’ above, candidates are not comfortable with designing field studies, which is what was really necessary here. It was quite common for them to try to design a laboratory experiment, which would have very limited validity in this context. The designs quite often lacked practicality – for instance, how can you study a fixed sample of 100 bees, in the field, over a period of years?

PACK B - PRACTICAL TASK
PART 1

There were few specific issues here. Some candidates drew a line of best fit which related to their expectation (a straight line going through the origin), rather than fitting it to the actual data points.

PART 2

No specific issues here, other than those mentioned in ‘general issues’, above.

PACK B - SAFETY TASK

Performance on this task was very similar to the equivalent task in pack A, with the main faults related to the risk assessment and the quality of communication. It is worth noting that there was no indication that candidates doing either pack performed significantly better or worse than those using the alternative pack.
SCIENCE: BIOLOGY

General Certificate of Secondary Education

Summer 2014

ADDITIONAL SCIENCE & SEPARATE SCIENCES CONTROLLED ASSESSMENT

Principal Moderators: Mr A Schmit
Mrs A Ebenezer

Overview

Teachers and candidates are developing a better understanding of the procedures and requirements of the controlled assessment tasks and marks are improving. However, there is still evidence of poor understanding of the detail of scientific methodology. In brief, candidates now know what they have to do, but cannot always do it.

This report covers both the Additional Science and Separate Sciences investigations, as the structures of the schemes are identical and the Additional Science investigations could also be used for Separate Biology, Chemistry or Physics.

Administration and marking

In general, samples were submitted on time and were well organised, with helpful annotation.

The quality of marking by the centres was generally satisfactory. Where errors occurred, these generally involved over-generous marking, particularly for candidates at the top end of the mark range.

One administrative issue that was mentioned in last year’s report but continues to cause concern is the practice of some centres using the practice work to investigate a variable, although it is clearly stated in the ‘Practical Guidance’ section of each investigation that this should not be done. The purpose of this rule is two-fold:

- Candidates must be able to choose their own independent variable. The use of one in the practice work may introduce bias towards investigating that particular variable in their own investigation.
- Candidates are expected to modify the technique used in order to investigate a variable. If they have already investigated a variable, no modification is necessary.

The purpose of the practice work is to show a basic technique, and to assess its repeatability and reproducibility. If a variable is investigated, it can actually disadvantage candidates. It will inevitably mean that less repeats can be performed, so limiting the assessment of repeatability. This is necessary for candidates to be able to access higher marks when they design their investigation. It is impossible for them to justify their suggested number of repeats based on the practice work if they have not done enough repeats to make such a judgement. In some cases, the practice work was not repeated at all, so making it impossible for them to access the marks for the justification of repeats. If the experimental method allows, it is far more beneficial to the candidates to do five or more repeats than to investigate a variable.

Some candidates may design experiments with too few repeats (or possibly too small a range of variables) because they do not feel the time allowed will allow them to do a large enough number. Candidates should understand that their design should relate to an ideal
(i.e. research) situation. If they cannot carry out as extensive an investigation in practice, they need simply note that and no penalty will be involved. The number of repeats must relate to observed variation in the practice work, and can be too many as well as too few.

Where marking was inaccurate, it generally related to a failure to penalise candidates for the types of fault listed in the Pupil Performance section, below.

Most centres seemed to be using the same task for both their Additional Science and Separate Science groups, and the submissions were therefore overwhelmingly of the Additional Science tasks.

Specific marking guidance – 10 to 12 band

The following points were mentioned in last year’s report, but there is evidence that they may still need clarification.

Hypothesising and Planning

One aspect of the assessment is judging the ability to research new information. This is assessed in this section. It is therefore reasonable to expect that the best candidates may go outside or even beyond the GCSE specification, finding information that they may not have been taught in class (as we do not aim to assess recall here). Alternatively (or additionally) their research may also turn up some data which can be used to compare to the results of their investigation. If the information given to back up their hypothesis is no more than they would have learned in class, they should demonstrate a very thorough understanding, clearly communicated, to be worthy of full marks.

Collecting, reviewing and processing data

"Correctly assess the sufficiency of the data" means that the candidate will consider whether the range and sampling intervals of the independent variable were adequate, and whether the number of repeats was sufficient. This should be informed by the actual data collected, and the scientific reasoning should be valid.

Analysing data and concluding

This is the only section that specifically assesses communication skills, although lack of clarity in all sections will result in lower marks, as the marker should never make assumptions if the candidate’s language does not make the position clear. That said, the assessment of spelling, grammar and scientific terminology relates only to the section of the work that could be broadly called ‘conclusions’. Good science with poor grammar and/or spelling must be penalised here, but only here.

Pupil performance

The sections below indicate common faults that occurred in the different investigations. Certain things, however, occurred in all of the investigations, such as:

- Poor explanation in the scientific knowledge used to inform the hypothesis (even amongst the more able candidates).
- Failure to properly relate numbers of repeats to the repeatability shown in the practice work.
- Misidentification of ‘anomalous’ results. Results which are generally consistent yet have anomalies are actually rare, and candidates should appreciate this. It is particularly unlikely for a mean result to be anomalous. If the mean is calculated from a set of data that has good repeatability, this suggests that it is not anomalous. If the
• mean has been influenced by one genuinely anomalous result, that result should have been ignored when calculating the mean. Candidates also refer to results as anomalous when they actually mean ‘unexpected’.
• Lines of best fit drawn inaccurately, or when the data points did not provide enough information to judge the appropriate position. Sometimes, the line was also too thick or ‘fuzzy’ to be fit for purpose.
• The erroneous belief that doing more repeats improves repeatability, or accuracy of results (only the mean is more accurate).
• Unscientific use of the term ‘accuracy/accurate’, unrelated to measurements. Also, confusion between accuracy and fair testing. When candidates refer to an experiment as accurate, it often seems to mean ‘free of problems’ or ‘generally okay’.

Most of these issues were listed in last year’s report, but as yet there is no significant improvement.

BIOLOGY INVESTIGATIONS

YEAST

There were few specific issues here. The main one was a weakness in the scientific theory. Some candidates treated the yeast as if it was an enzyme, referring to collisions between the substrate and the yeast. Others referred to the energy of the collisions, although with an enzyme, only the frequency is important. In some cases they actually referred to the yeast ‘reacting with’ the substrate.

HANDEDNESS

As with all the Separate Science investigations, we saw relatively few examples of this in the samples. This was a different sort of investigation to the usual, yet candidates coped reasonably well with it. The main fault was in investigating just ‘handedness’ (i.e. right handed or left handed), rather than the degree of handedness. This meant that the independent variable became discreet, which limited the marks available.

CHEMISTRY INVESTIGATIONS

THIOSULFATE

In this investigation there was occasional ‘overkill’ in the control of variables, e.g. the type of paper, the colour of the cross or the pen used to make the cross. The risk assessment here was more extensive than in the other Additional Science investigations, and the old faults resurfaced. Notably failure to indicate the nature of the hazard (either completely, or putting it in the ‘risk’ column) and failure to link a stated risk to an action which was part of the method.

ELECTROLYSIS

Hardly any examples of this investigation were seen, so the sample cannot be representative of the entry in general, and no generalised comments can be made.

PHYSICS INVESTIGATIONS

SQUASH BALLS

In this investigation, some centres actually varied temperature in the practice work, whereas it was intended that a single temperature should be used. Judging the height of the bounce by eye is inherently inaccurate, yet many candidates failed to pick up on this when considering the evidence and suggesting improvements.
VOLUME OF GAS

As with the other Separate Science investigations, the number of these tasks seen was very small. No common faults were obvious in the samples seen.