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GCSE
BIOLOGY

SUMMER 2019

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UNIT 1: CELLS, ORGAN SYSTEMS AND ECOSYSTEMS – FOUNDATION TIER

General Comments

The questions on this paper of one hour and 45 minutes were more accessible to the candidates at the start of the paper than at the end and the overall trend was one of gradual decrease through the sequence of questions. As is often the case, the final and penultimate questions, which also occurred on the higher tier paper, presented the greatest challenge to foundation tier candidates. The tendency for questions to be left unanswered, increased through the paper but this could reflect difficulties with time management for the candidates as well as difficulties with question content.
In some instances, the marks recorded for questions set in a practical context were somewhat disappointing and questions which required responses in continuous prose were not well answered. There were some good responses with questions requiring analysis of data.

Comments on individual questions/sections

Q.1 Most candidates selected the correct terms to complete sentences on cells and tissues and were able to name the digestive system correctly. This was one of the most accessible parts of the paper. Difficulties did arise, however, in naming the oesophagus on a diagram and in explaining the meaning of the term specialised cells. Many answers just repeated the question. Although many candidates did not include muscle contraction in a description of peristalsis, almost all knew that it resulted in the movement of food through the digestive system.

Q.2 In this question on enzymes, many candidates showed some knowledge of key points. They could identify the active site, complete a diagram to show an enzyme-substrate complex and show an understanding of denaturation. In contrast, few were able to name the enzyme as a protease or identify amino acids as the products.

Q.3 It was clear from many answers that candidates had experience of practical work involving the use of Visking tubing and were familiar with tests for starch and glucose. It was unfortunate that many marks were lost in a number of cases because of a failure to recall the correct colour changes related to positive results or to state that Benedict`s reagent required heating. Generally, answers recognised the role of Visking tubing and the importance of molecule size in relation to the movement of molecules but responses were poor when candidates were asked to describe the expected action of a carbohydrase on starch.

Q.4 Again it was clear from answers that candidates were familiar with the practical context of this question, which related to the assessment of energy content in foods by burning. Marks were lost heavily on the section dealing with a risk assessment because answers did not link risks to actions or suggest suitable control measures. Too many answers simply made vague references to being careful. Answers were better for the rest of the question with good suggestions for fair testing and the calculations of energy release were done correctly.

Whereas almost all answers did identify the correct type of pasta with the highest energy content, the mark here was often inaccessible because of a failure to recognise the importance of expressing energy values per gram in making comparisons.

Q.5 In the first part of this question it was pleasing to see that almost all candidates were able to complete the word equation for aerobic respiration. The second part of the question presented more of a challenge where an extended response was needed. The question required candidates to describe the differences in the various gases present in inspired and expired air and to give reasons for the differences. The mean of 2.2 marks out of a possible six placed most answers in the lower band of the range of marks available. Generally answers correctly described the differences but only the best answers went on to explain changes in oxygen and carbon dioxide percentages in relation to respiration. In good answers the points were described in a logical sequence and expressed in clear language.

Q.6 This question, on the topic of photosynthesis required the candidates to plot a graph and this was generally done well with the marks available here proving to be the most accessible on the paper. The subsequent descriptions of the effects of temperature on the rate of photosynthesis and the calculation were done correctly. Issues did arise, however, in the identification of an optimum temperature and very few answers made suitable suggestions for ways to increase accuracy. Often vague answers such as “do more tests” were given.

Q.7 For this question, which was also on the higher tier paper, it was necessary for candidates to read and assimilate a substantial quantity of detailed information. Almost all the candidates were able to construct a food web of the marine sea organisms, based on information in the first part of the text. The rest of the question, dealing with the effects of PCBs was more problematic. Most answers described the passage of PCBs through food chains as being the cause of death in killer whales but did not refer to bioaccumulation. Most answers suggested that the presence of the banned substance PCBs in the oceans was caused by poor management of plastic waste by humans but did not refer to the long-term persistence of PCB molecules.

Q.8 This question set in the context of a practical investigation of transpiration, was also on the higher tier paper and foundation tier candidates experienced difficulty in accessing the marks available. Some gave relevant answers for the uses of water in plants and could identify xylem as the tissue which transported water but answers such as “stems” or “roots” were frequently seen. The calculation of the rate of transpiration was carried out correctly in only a minority of cases and errors were made in comparing the results for two species. Very few were able to explain why a potometer could not be used to measure the transport of sugars. Some candidates, however, gave good answers when asked about factors which should be kept constant during the investigation and understood concepts of repeatability and reproducibility.

Summary of key points

- Candidates answers to a number of questions set in practical contests show that they have experienced practical work. However, they would be more able to access available marks if the details of methods and techniques were revised more thoroughly. Examples here include the details of tests for glucose and starch and the requirements to link risk assessments to actions in practical procedures.

- In a number of questions requiring straightforward use of factual information, valuable marks were not accessible because scientific vocabulary could not be recalled accurately. For example, more thorough revision of the topics such as the parts of the digestive system and the essential terminology relating to enzymes would be beneficial.

- Many candidates would have been able to access marks in questions requiring answers in continuous prose if they paid greater attention to the wording of the question to ensure that important elements we not missed. In particular, this would enable more candidates to achieve marks in the middle and higher bands of questions requiring an extended response.

- Graph drawing skills were generally good on this paper, but candidates could benefit from greater practice at drawing clear lines and adding the scales to axes. While most candidate recognise the importance of repeats when asked to suggest improvements to investigations, they need to pay more attention to ways of increasing accuracy.

- As in previous years, candidates need to be aware that poor handwriting can result in many valuable marks being lost. Performance would surely be improved if they paid greater attention to the legibility of their scripts.

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UNIT 1: CELLS, ECOSYSTEMS AND ORGAN SYSTEMS – HIGHER TIER

General Comments

This year's paper provided candidates with a mix of topics in familiar and novel contexts. Candidates performed well on the majority of the calculations, however percentage changes still remain a major problem for a large majority. When faced with questions based on practical work, candidates performed well. Problem solving in unfamiliar settings still provides a stiff challenge for many candidates and evaluation of the scientific method in day to day contexts also seems a struggle.

Comments on individual questions/sections

Q.1 Parts (a) and (b) did not present a problem to the majority of higher tier candidates. Bioaccumulation is a topic which has been examined for many years, but still remains a challenge to the candidates' ability to communicate scientific ideas. In part (d), far too many gave a description of PCB's being passed along a food chain and failed to explain that it is the toxic dose, or level, at the top of the food chain which leads to the death of the killer whales. Most candidates were able to identify from the text another effect of PCB's on killer whales, however some stated that PCB's affected fertility without qualifying that it was a negative effect. In part (e), many were just stating that there were tonnes waiting to be disposed of in Europe whilst some were saying that the plastics didn't decompose rather than the PCB's.

Q.2 (a) & (b)

Parts (a) and (b) were successfully answered by most.

(c) For the calculation in part (c), if candidates had studied the unit provided it would have given them a clue as to how to proceed with the calculation. It was unfortunate to see that a few lost marks here as they were unable to correctly round up the number from their calculation.

(d) In part (d), those who had experience of practical work with potometers did well. Poor answers given were 'amount of water' and 'size of bubble', demonstrating a failure to grasp how the potometer worked.

(e) Part (e) proved to be the most difficult part of the question. Candidates seemed to find it difficult to apply knowledge to solve unfamiliar problems.

Q.3 (a) Risk assessments are an essential part of practical work; candidates find it difficult to identify hazards and describe risks. The facility factor of 11.4 in part (a) underlined this problem. Very few were able to score here and of those who did, most were able to gain the first mark. The slide or coverslip smashing was often seen. For the second marking point, very few described the action that caused the risk.

(b) There was an interesting selection of drawings provided by candidates in part (b). Candidates who had experience of using microscopes to examine plant cells and produce labelled scientific drawings did well. Some just drew a generalised plant cell, and cell membrane was often used as a label even though this would not have been seen.

(c) It was pleasing to see that candidates were better able to answer part (c), demonstrating that this aspect of microscopy is better emphasised as this specification matures.

Q.4 Osmosis is an abstract concept for candidates in Year 10 and difficult to grasp by many. A large number of candidates discussed the movement of sugar or of the sugar solution thus negating most of the available marks. There was also a failure to be clear that there is a difference in the concentration of **water** between the inside and outside of the bag. The marking point for the partially permeable membrane in the context of this question was given independently to credit the recognition of the role of the Visking tubing as a membrane.
Many were able to identify the concentration and give a reason.

Q.5 **(a)** Part (a) was answered well.

(b) There were many good responses to part (b), with many more candidates able to gain marking points 1 and 4 than marking points 2 and 3. Some did not note that the rubber sheet was pulled *down* and that the balloons *inflated*. For marking points 2 and 4, volume and pressure were either not described or the description was the reverse of the correct description.

(c) Most candidates were able to describe the limitations provided by a rigid bell jar in part (c). Of those who scored both marks the first and third alternatives were the most popular answers.

(d) Part (d)(ii) provided some very good answers, however some candidates showed a misunderstanding of how the model works by stating that air would escape out through the hole when the rubber sheet was pulled down.

Q.6 **(a) & (b)**

Parts (a) and (b) posed no real problem for most.

(c) The vast majority of candidates were able to identify both enzymes in (c)(i). Part (c)(ii) gave good responses, reflecting the popularity of this question over the years. Some candidates showed misunderstandings by stating that '*bile emulsifies fats which breakdown large molecules into smaller molecules'*.

(d) In part (d), most were just gaining the first mark, with denatured being seen less often.

(e) In part (e), again the first mark was the one accessible to most, with the second only seen in some.

Q.7 This question challenged most candidates with a facility factor of 33.6 indicating most answers given were borderline low to middle band. Advantages seemed to be the most commonly seen of the indicative content, followed by the disadvantages. Very few were able to give a coherent account of the role of an environmental impact assessment.

It would help if candidates were reminded that there are additional pages at the back of the examination booklet to continue their answers as a number of candidates stopped their answer mid flow when they reached the bottom of the page provided.

Q.8 **(a)** For part (a), it appears that the concept of 'bulk' in the diet is unfamiliar to most candidates.

(b) Most were unable to identify any of the health risks associated with high sugar content in food in part (b).

(c) The calculations in part (c) were answered well by most. Many failed to score a mark for the third column, with 658 kJ often being seen.

(d) Part (d) was the most difficult question on the paper, once again percentage changes prove to be a mathematical requirement which candidates find difficult to grasp. The candidates seem to find it difficult to choose the correct denominator.

(e) Part (e) was not well answered, with many failing to link the design to the improved efficiency. A large number of candidates lost marks by stating that the apparatus prevented all heat loss rather than reducing heat loss.

Q.9 **(a)** Part (a) was answered well.

(b) For part (b)(i), many were able to use both graphs to get an estimate. Unfortunately, some lost the mark because they did not provide a unit. It is worth reminding candidates that on the higher tier, if a unit has not been provided on the answer space it will be expected to be given.
Not many identified limiting factors in (b)(ii) even though part (a) had been given as a clue for the candidates.

(c) Parts (c)(i) and (ii) seemed to be beyond the grasp of the majority of candidates. Not many were picking up on the *global changes* referred to in the question, preferring to give a stock response of '*repeat the experiment*' instead of *'repeat the experiment around the world'*. For (ii) candidates lacked the concept of greenhouses being closed environments and therefore factors can be controlled inside as opposed to there being many uncontrollable factors outside. Also, many did not set out their answers in a comparative way as required by the wording of the question, referring solely to either inside or outside only.

Summary of key points

- Candidates need to develop their language to improve their explanations, e.g. in 1(d) they were referring to the amount of PCB's increasing rather than the concentration. In 5(b) they were losing marks by stating that balloons expand rather than inflate.

- Candidates need to be encouraged to develop a problem-solving approach to answering questions. A PIP approach can be most helpful. P – identify the problem; I – identify the information required; P – plan their answer. This can be most useful when presented with contemporary scientific issues e.g. in question 7, by identifying the problem as being issues surrounding intensive farming, candidates can then identify the information required and plan their answer appropriately.

- Risk assessments are being answered poorly by the majority of candidates. For the hazard, candidates should be drilled to identify how an object or activity is dangerous and for the risk, they need to identify an action + injury. The ability to assess risk should not be left until the Unit 3 practical assessment.

- Percentage changes is a mathematical skill which continues to challenge most candidates and opportunities for practice should be continued and encouraged.

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UNIT 2: VARIATION, HOMEOSTASIS AND MICRO-ORGANISMS – FOUNDATION TIER

General Comments

As in the previous examination series, many foundation tier candidates experienced a challenge in working through a paper of one hour and 45 minutes in length. This may be the reason for candidates not attempting some questions, particularly the longer and more complex questions towards the end of the paper. It was, however, pleasing to see attempt rates of over 99% for the earlier questions.

Some good responses were seen on the earlier questions on the paper especially where an element of response to data was involved. Generally, however, the accessibility of the tasks, as shown by the responses of candidates, decreased through the sequence of seven questions from the start to the end of the paper. The low scores for the last question, which also appeared on the higher tier, reflected a level of difficulty which was too demanding in terms of content and complexity for most foundation tier candidates.

Comments on individual questions/sections

Q.1 In the first part of his question, candidates were required to read a section of text about the issue of obesity and then to analyse some related statements. Most answers were credit worthy with many gaining the full three marks. When asked to recall how hormones travelled most candidates correctly referred to the blood.
The second part of this question about trials for new drugs was also accessible to most candidates but some struggled to accurately describe the role of a placebo, with many responses making vague references to “false” or “fake” drugs.
The last part of the question asked candidates to identify advantages of alternatives to the use of animals in testing drugs and this proved to be inaccessible to most. The majority of answers consisted of emotive statements with no reference to ethics or to practical advantages.

Q.2 Candidates who had experience of practical work in microbiology and the use of aseptic technique coped well with the first part of the question relating to the preparation of agar plates.
The second part of the question required the plotting and reading of graphs from given data and most candidates showed that they had the relevant skills to access most of the marks available here. When marks were lost, it tended to be for carelessness such as failure to show the origin on the scale or to label the line drawn.
The final part of this question was not well answered and only a few candidates, when given a context of poor hygiene, were able to describe the precise flaws in the method of food storage in the example given.

Q.3 Approximately 8 % of candidates did not attempt this question, which was more than the other questions which appeared only on the foundation tier paper.

The first part needed them to recall the names of two structures on a straightforward diagram of the skin, which was not done well and few answers consisted of two correct labels. The erector muscle was frequently named as sweat duct or a blood vessel.

The second required an extended answer in the context of skin function. The marks awarded, whilst being a slight improvement on previous years, were generally in the lower band with higher marks not being accessible to the majority of candidates. It was frequently the case that candidates wrote about skin functions in a very general sense and did not answer the question set, which asked about the response to a cold environment. Many answers were poorly structured.

Q.4 Many candidates performed well on the part of the question about issues relating to whooping cough vaccinations. When they were required to read a passage of information and respond to the data provided there were many correct responses and the calculation was usually correctly done. Greater difficulty was encountered when candidates needed to draw conclusions and identify points of evidence to support assertions about the effects of changes in rates of vaccinations. Many candidates were not able to select and use scientific terms related to the immune system, in order to complete a sentence.

Q.5 This question was set in a context of practical fieldwork and it was disappointing that the marks attained were generally low. Very few could describe a sampling method using random quadrats and there were many vague references to quadrats simply being “thrown”, which did not gain the marks available. The multi-stage mathematical task to estimate plant density was not attempted by almost 9 % of candidates but many of the answers given were correct. A number of candidates were able to draw suitable conclusions from the bar chart comparing two aspects of an investigation and understood the concept of reproducibility. The parts of the question requiring candidates to describe the importance of testing biological control agents and predicting changes in biodiversity were very demanding for most candidates and were not well answered.

Q.6 There were many good answers to some parts of this question, which also appeared on the higher tier paper. Candidates could usually identify the correct sex chromosomes for human males and females and almost all could complete the following Punnet square accurately, showing a good understanding of genetic principles. The calculations of mean heights were generally done correctly and these values were used appropriately to evaluate a hypothesis. Most answers included suitable suggestions for improving the strength of the evidence for an investigation by obtaining a larger sample size. Very few, however, identified the source of error in the method for recording heights of individuals and 15 % of candidates did not attempt this task.

Q.7 This question on cystic fibrosis presented candidates with a difficult challenge and few had the skills to access the marks available. Very few candidates were able to explain the term “recessive allele” and most could not adequately analyse the information given in the family tree. There were some answers which showed an awareness of gene therapy and interest in the topic but only a small minority give appropriate descriptions of the difficulties in making the treatment successful. Approximately 20 % of candidates did not attempt to answer this question.

Summary of key points

- In a number of questions requiring straightforward use of factual information, valuable marks were not accessible because familiar scientific terms could not be recalled accurately. Confusion between antibodies and antigens and also between structures in the skin were examples of this. More thorough revision by candidates would improve performance.

- Questions requiring extended written responses are a challenge for many foundation tier candidates but they often display an interest in the topics. They would be well advised to read questions more thoroughly and focus their answers upon the material which is actually required in answers and avoid including information which is not relevant.

- Answers to questions set in practical contexts show that candidates have some experience of relevant tasks but there is a lack of detail when they are asked to describe procedures. Questions relating to aseptic technique or placing quadrats at random are examples of this, with valuable marks being lost.

- When asked to suggest improvements to investigation methods most candidates are aware of the need to provide adequate sample size and experimental repeats but need to devote more attention to giving reasons for conclusions.

- The large percentage of candidates not attempting the last question on the paper suggests that more emphasis needs to be placed on time planning as they work through a paper of this length. Adequate time needs to be allowed for dealing with the more complex questions at the end of the paper.

- As in previous years, candidates need to be aware that poor handwriting which results in answers being illegible, can results in many marks being lost.

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UNIT 2: VARIATION, HOMEOSTASIS AND MICRO-ORGANISMS – HIGHER TIER

General Comments

Candidates who had learnt their work performed well on this paper. Overall there was a good response to the mathematical questions and those dealing with experimental skills. Demonstration of knowledge and understanding by recalling scientific names and definitions still remains a challenge for most candidates and is an area which requires improvement.

Comments on individual questions/sections

Q.1 (a) & (b)

Parts (a) and (b) posed no real problems for the candidates.

(c) For higher tier candidates, the greatest difficulty was posed by part (c). Many still confuse inaccuracy with the idea that a mistake has been made; the most common incorrect response here being that the height was incorrectly converted. Candidates should be taught to look for an error in the method when identifying an inaccuracy.

Q.2 This turned out to be the most challenging question on the whole paper.
The majority of candidates were unable to give a definition of either *recessive* or an *allele*.
Part (b)(i) was the most accessible part of this question with most being able to state the effect of a mutation.
In part (b)(ii), most were able to identify two heterozygous individuals. However, it appeared that not many were using all the information given in the family tree. The diagram clearly stated that individual 6 did not have CF according to DNA test, but far too many candidates were still suggesting that individual 6 should have their DNA tested!
Part (c)(i) provided most of the marks here with only a few being able to score any marks in part (ii).

Q.3 This question rewarded those who had learnt their work and posed no real difficulties.

Q.4 (a) Candidates struggled with the recall nature of parts (a). Most were unable to give the correct scientific name for chlamydia in (i), whilst more were able in (ii) to identify it as a bacterium.

(b) The majority of candidates knew how to prevent the spread of chlamydia, as shown by the facility factor of 78.7 in part (b).

(c) The candidates coped well with the calculations in part (c).

(d) Most candidates had a tendency to restate the question in part (d). The most common answer seen was, 'to raise awareness of how to prevent the spread of chlamydia'. This did not address the question of how the awareness is improved, i.e. by improving education or knowledge of how to prevent chlamydia, and its importance in reducing the number of cases, because they are still increasing in number.

Q.5 This question was the second most accessible on the whole paper. It suggests that this topic is taught well in most centres.
Part (e) posed the greatest challenge to candidates, with a large number ignoring the question by only giving one precaution or giving two precautions that were both linked to the marking technique.

Q.6 **(a)** Part (a) posed no real problem.

(b) Most answers to part (b) were in the bottom part of the middle band. Candidates were correctly linking more ADH to reduced volumes and increased concentrations of urine. The most common omissions were those linked to the blood, e.g. no reference to low water levels in the blood, ADH being carried in the blood, water being reabsorbed back into the blood. This question was a reward to candidates who had studied their work.

Q.7 This question was the second most challenging on the paper.

(a) Only a small number of candidates were able to correctly describe the process of genetic profiling (facility factor of 19.0). This was surprising as this question has been asked many times in the past.

(b) Candidates struggled with part (b). The answers suggest that they were unfamiliar with the use of genetic profiles to identify paternity. Answers seen were *'the bands of the lamb are similar to the sheep, therefore the lamb is related to the sheep'*, suggesting that they had not studied the stem of the question in detail, as this was clearly stated.

(c) Candidates gave many good responses in part (c), demonstrating a knowledge of the ethical issues surrounding this technology.

Q.8 **(a)** Most candidates were unable to give the basic assumption in part (a) that underlines viable cell counts.

(b) For part (b), most candidates were able to state at least one aseptic technique. However, most gave a reflex response to (b)(i). An example of a common response was, '25 ^{o}C to prevent the growth of pathogenic bacteria'. As the bacteria in the question caused infections in human wounds, this was obviously incorrect.

(c) The majority of candidates were able to gain some marks in part (c) by showing their working.

(d) Part (d) was the most accessible part of the question, and it was good to see candidates being able to suggest improvements to accuracy in part (ii).

(e) Part (e) examined a new topic introduced in this specification, and most candidates were able to score at least one or two marks here.

Many candidates did not necessarily give the three stages in the correct order, but they were not penalised as the sequence was not being examined here. The most common mistake was stating that the drugs were tested on *volunteers*. This should have been *healthy volunteers*.

Q.9 (a) & (b)

Recall was an issue in parts (a) and (b), with far too many unable to state the function of the cornea or the meaning of the term *stem cell*.

(c) Most candidates were able to identify mitosis as the type of cell division in (c) and its importance in producing genetically identical cells. Not many however used diagram 2 to help them recognise that mitosis allowed the production of more cells.

(d) Part (d) was not answered well, with too many overthinking their answers. By using diagram 1, they should have realised that example 1 depends on healthy stem cells, and damaged eyes would not have any healthy stem cells.

(e) Most candidates were able to apply their knowledge of the advantages of stem cell technology to part (e). The most common responses were a reference to there being no or less issues of rejection and no or less ethical issues involved with example 1.

Summary of key points

- Candidates should be reminded to study the command words in a question and the number of marks available. This should help them better structure their answers. For example, in question 2(c)(ii) they are asked to **describe two** difficulties and **suggest** why the therapy is not a permanent cure. With three available marks this would indicate a three-part structure to the answer; two descriptions and a suggestion.

- When studying the topics, it would benefit candidates if they were to have the opportunity to apply their scientific knowledge to contemporary scientific issues. For example, teaching of genetic profiles generally involves their use in cases of criminality and candidates tend to learn one particular way of interpreting results. However, genetic profiling has many uses all of which require different interpretations. If candidates are not exposed to a range of contemporary issues they tend to be inflexible in their application and interpretation of scientific knowledge. This can be seen in the responses to question 8(b).

- Recall of terms and definitions remains a challenge, and centres should explore different techniques to try and address this problem.

- Candidates need to be encouraged to use all the information provided to them in the stem of the question and any diagrams given, e.g. see the comments for 7(b), 8(b) and 9(c).

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UNIT 3: PRACTICAL ASSESSMENT

General Comments

It was pleasing that there was again a good spread of marks with the vast majority of candidates attempting most questions. Some positive achievement was seen from candidates across all qualifications and abilities. However, explanations requiring the demonstration of scientific knowledge were often poor.

SECTION A

Risk Assessment
The nature of the hazard was not always clearly identified (e.g. acid is an irritant) and the risk often lacked an action (e.g. acid splashes on skin whilst pouring into beaker). Where candidates accessed the provided student safety sheets, they did not always select information which was relevant to the task.

Table of results
The majority of tables were well structured and logically organised although candidates tended to lose marks for incorrect units or putting units in the body of the table.

SECTION B

Graphs
Many candidates were able to plot graphs correctly, although lines of best fit were often poor or not attempted. Many candidates did not start their scale at the origin and should be encouraged to do so.

Variables
Generally, candidates are confident in identifying the independent and dependent variables in different investigations indicating that these terms are well understood. Candidates were usually able to identify controlled variables but stating how they were controlled, referencing both instrumentation and the value measured was not done well.

Evaluation of quality of data
Repeatability and reproducibility were generally well understood; however, the terms accuracy and precision are still poorly understood. The idea of random error was not well known. Calculating uncertainty from a given equation proved very difficult. Suggesting improvements however was often well done.

Comments on individual questions/sections

INVESTIGATING THE EFFECT OF SIZE OF AGAR JELLY BLOCKS ON UPTAKE BY DIFFUSION
This practical was available to both double award and separate science candidates but was not a popular choice.

SECTION A

(a) The hypothesis was usually correct.

(b) The risk did not always have a clear or relevant action associated with it with many candidates talking about acid splashing into eyes.

(c) The table was usually well done although some gave vague references to the 'size' of the cube.

SECTION B

(a) (i) (ii) and (iii)

The independent variable, the range and the dependent variable were usually identified correctly. Many candidates attained marks with error carried forward from the use of 'size' in the table.

(b) Graph plotting here was generally good.

(c) **(i)** Almost all candidates here attained one mark of the two allocated. They could describe the relationship between the variables but did not develop their answer to suggest whether the increase was at a constant rate.

(ii) Candidates were able to interpret their graphs to determine an estimate for the colour remaining after 3 minutes.

(d) Most understood the concept of reproducibility.

(e) Most candidates scored highly here.

(f) Making conclusions from the data given was often done well.

(g) **(i)** Diffusion was usually described soundly.

(ii) This final question linked theory with the experimental results and it proved to be very discriminating with only the most able attaining full marks.

INVESTIGATING THE EFFECT OF LIPASE A CONCENTRATION ON MILK

SECTION A

(a) In the risk assessment, the hazard was poorly described and, as has been the case throughout, the risk was poorly expressed as candidates were unable to correctly describe an action which would constitute a risk in the procedure.

(b) The table of results was generally laid out well but the conversion of minutes into seconds proved to be a challenge for a number of candidates.

SECTION B

(a) The independent variables and dependent variables were well answered as was the range.

(b) The usual problems were seen with this graph question in terms of the correct scale on the *y*-axis, the candidates struggled with the high values for time.

(c) The majority of candidates correctly described the relationship between the independent and dependent variables.

(d) Candidates often identified in accuracies but were less strong on describing the corresponding improvement.

(e) This was very poorly answered with very few candidates able to state the need to include the denatured enzyme.

(f) Although it was apparent that most candidates understood why the experiment was not suitable for investigating pH but many had trouble explaining this effectively.

(g) This part was well answered.

(h) Most candidates succeeded in recognising the fact that the enzyme would be denatured but fewer were able to correctly relate this to the active site shape and the inability for the enzyme substrate complex to form.

Summary of key points

- Encourage candidates to identify the nature of any hazard and to always link a risk with an action in the method.
- Allow plenty of opportunity for candidates to plot graphs. They should have suitable practice in determining their own scales which include values at the origin and they should develop a clearer understanding of what constitutes a good line of best fit.
- Practice method writing to ensure that candidates write concisely and clearly in a suitable style.
- When undertaking practical work, encourage candidates to draw links between the results collected and scientific theory.
- Give candidates experience of judging the reproducibility and repeatability of given data.
- Ensure that candidates understand the significance of a dot above a digit on their calculator screens so that they do not make errors in rounding.

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