

GCE



**Chief Examiner's and
Principal Moderator's Report
Life and Health
Sciences**

Summer Series 2018

Foreword

This booklet outlines the performance of candidates in all aspects of CCEA's General Certificate of Education (GCE) in Life and Health Sciences (Single and Double Award) for this series.

CCEA hopes that the Chief Examiner's and/or Principal Moderator's report(s) will be viewed as a helpful and constructive medium to further support teachers and the learning process.

This booklet forms part of the suite of support materials for the specification. Further materials are available from the specification's microsite on our website at www.ccea.org.uk.

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GCE LIFE AND HEALTH SCIENCES (SINGLE AND DOUBLE AWARD)

AS Units: Principal Moderator's Report

Introduction

In the 2018 cohort of candidates taking AS level Life and Health Science the samples provided for moderation across the internally assessed units indicated that:

Teachers for the most part had:

- Provided their pupils with suitable and appropriate opportunities by way of experimental and investigative pupil objectives and activities which allowed them to present portfolios of evidence which would demonstrate the achievement of all Learning Outcomes and access all mark bands in the Assessment Objectives for the subject specification.
- Applied the assessment objective mark criteria correctly and awarded marks commensurate with the quality of the pupil response.

Candidates continue to access marks in the higher mark bands in the Learning Outcomes and Assessment objectives which require them to:

- Organise and present information; the listing of materials and equipment, drawing of diagrams, presentation of results tables etc.
- Demonstrate safe and skilful practical techniques; there was little Teacher annotation to the contrary.
- Make observations with appropriate precision; data was collected and observations made and recorded successfully throughout the portfolio units whether for Experimental Techniques or investigations for Brain Science or Medicine Drugs and Clinical Trials.
- Devise and refine experimental and investigative activities, selecting appropriate techniques; candidates were able to select appropriate techniques in their introductions for Unit 1 and identify and use appropriate activities and techniques in their investigations in Units 4 and 6.
- Working independently to select and interpret appropriate information; candidate responses did indicate that they were able to competently select and handle their own and others data in an appropriate way whether that be tables and graphs in Units 1, 4 and 6 or in factsheets and summary observations and reports or work logs in Units 4 and 6. It was the interpretation of this information in the higher mark bands which was in many instances not demonstrated.
- Describe significant trends and patterns shown by data presented in tabular or graphical forms; candidate responses in the results sections across the units demonstrated that they could mostly state trends and patterns but some difficulty arose when translating these trends and patterns into interpretations, findings or conclusions across Units 1, 4 and 6.
- Translate data presented as prose, diagrams, drawings, tables or graphs successfully from one form to another; irrespective of whether candidates were working with periodic times and pendulum lengths (Unit 1) or the bioassay and quantitative analysis (Unit 6) they were mostly able to handle and translate data from one form to another.

- Write succinctly, clearly and coherently using specialist terms with appropriate referencing; for the most part candidates' responses across the units were clear, coherent and fluent and in many instances demonstrated a high level of scientific terminology and specialist terms.

However, when it came to the more challenging assessment objectives of AO2 and AO3 candidates did find it more difficult to access the higher mark bands.

- Record methodically; this was not always evident, even when candidates had correctly tabled results and noted observations in activities across the AS internally assessed units, precision and methodical recording was not consistent with 'some' headings and units absent and not all data recorded to two decimal places. These inconsistencies are not acceptable at this level and certainly not when attempting to access the higher mark bands.
- Apply skills, knowledge and understanding of processes, techniques and equipment to a range of contexts; this application should be evidenced across all three AS units in report and investigation introductions, hypotheses, suggested outcomes and indeed the assessment of risks and the detail of how data might be handled e.g. in graphs etc. This was not always present to allow for higher mark bands.
- Carry out risk assessments; these were always present across the internally assessed units but frequently there was a lack of detail and the generic nature of some risks showed little application to the particular report, investigation or piece of research.
- Researching, using primary and secondary sources, and analysing and presenting findings from the research undertaken; once again this did stretch candidates across the units whether it was the report on the bioassay of medicines outlined in unit 6, in the introduction or conclusions of an experimental technique for Unit 1 or a piece of statistical research on an aspect of mental health in Northern Ireland in Unit 4.
- Interpret, explain, analyse, evaluate, draw conclusions from their own and others investigative and experimental activities making reasoned arguments; this is where candidates found it most difficult to access the higher mark bands introductions, report findings, conclusions, refinements and evaluations across Units 1, 4 and 6 indicate candidates still experiencing difficulty.

Teachers and Assessors who will obviously wish to optimise the achievement of their students should take note of the following outcomes of the moderation process across the internally assessed units of this specification.

- The subject specification indicates that centres must use the Candidate Record Sheets. (now referred to as Candidate Mark Records). This does not happen in a small but significant number of centres.
- The candidate portfolio must evidence the achievement of all the unit Learning Outcomes. This is a requirement of the subject specification and in a number of centres this is not evident or immediately evident.
- Where Candidate Mark Records had been correctly used by centres this was to the advantage of the candidate allowing the centre to identify where marks had been awarded in the portfolio and why they had been awarded. Thus, making clear the mark and mark band.
- Where Portfolio Checklists provided by CCEA or centre designed checklists had been used by centres the candidate could clearly and easily evidence the achievement of all the Learning Outcomes for the unit.
- The setting of appropriate and suitable pupil objectives and activities by the teacher is key to providing candidates with the opportunity to access the full mark range.

In summary candidate responses to; organising and presenting information, making precise observations, devising and refining experimental and investigative activities, selecting appropriate techniques, describing trends and patterns from data in tabular or graphical forms and translating data in a variety of forms from one form to another, resulted in candidates providing portfolio evidence by way of introductions, equipment lists, labelled diagrams, procedures, tables, graphs factsheets etc. which allowed them to access the higher mark bands. Whereas candidate responses to; methodical recording, applying skills, knowledge and understanding of processes, techniques and equipment to a range of contexts, carrying out risk assessments, researching and using primary and secondary sources, and Interpreting, explaining, analysing, evaluating and drawing conclusions from their own and others investigative and experimental activities making reasoned arguments, elicited candidate responses in portfolio evidence by way of introductions, findings, conclusions and evaluations which were not in the higher mark bands.

On the whole centres and candidates had worked diligently to meet the specification submission requirements, produce and present solid portfolio evidence and mark fairly and in line with CCEA guidelines.

It is important to note that support is available to address any of the issues raised in this report by way of the Centre Report TAC6, Agreement Trials and Portfolio Clinics. The most up-to-date information and support material can be found on the CCEA microsite for Life and Health Science.

The following Unit-specific comments have been provided by the relevant Assistant Principal Moderators, incorporating feed-back provided by the Moderators in their various teams. The comments are intended to direct centres towards best-practice in the generation of candidate portfolio evidence.

Assessment Unit AS 1 Experimental Techniques (SZ011)

Portfolio Requirements

In the 2018 cohort the majority of centres met the requirement to use the updated CCEA Portfolio Checklist and Candidate Mark Records for this unit and some centres had used the CCEA Pro-forma to assist candidates in structuring their evidence. The majority of reports had been produced according to the requested format and although not all candidates had written using the impersonal past tense nor met the requirement for candidates to provide a bibliography for each report there was a marked improvement in the quality and standard of the work sampled and in the organisation and presentation of the portfolios provided for this series.

Learning Outcomes and Assessment Objectives

On the whole, with few exceptions, centres had completed 12 reports matching each of the learning Outcomes 1.1.1 through to 1.3.4. Consequently, it was clear from the presentation of the portfolios that the requirement for all learning outcomes to be evidenced had been met. In a small but significant number of centres the learning outcome codes had not been used on the various reports and this did pose some difficulties when matching the report to the Teacher awarded mark. There was some evidence that candidates were finding it slightly more difficult to access the higher mark bands in Learning Outcomes 1.2.1 to 1.2.4 but for the most part the nature of the experimental technique/learning outcome did not present a challenge to candidates in their opportunity to access the higher mark range. Candidates were able to organise and present information, make observations with appropriate precision, devise and refine experimental and investigative activities, selecting appropriate techniques, translate data presented as prose, diagrams, drawings, tables or graphs

successfully from one form to another and write succinctly, clearly and coherently using specialist terms with appropriate referencing; as was evidenced in the report introductions, materials and apparatus lists, procedures, risk assessments and results. Indeed, for the most part candidates were able to easily access the full mark range in these assessment objectives as was evidenced in the materials and apparatus and procedure sections of their reports for each Learning Outcome. What did however provide the candidates with a much greater challenge was methodical recording, applying skills, knowledge and understanding of processes, techniques and equipment to a range of contexts, carrying out risk assessments, researching and using primary and secondary sources, and Interpreting, explaining, analysing, evaluating and drawing conclusions from their own and others investigative and experimental activities making reasoned arguments. The candidate response to these assessment objectives did not allow them to easily access the higher mark bands. This was evident in the portfolios of even very capable candidates where they could not consistently:

- In their introductions state a prediction/hypothesis or expectation of results in anyway referenced/linked to the centre-defined Objective or include relevant scientific reasoning.
- In their Risk Assessments identify the hazard, the risk, and the control measures with specific references to COSHH and CLEAPSS where appropriate that were specific to that investigation and the materials and apparatus used. As undertaking Risk Assessments is a standard laboratory activity it is acceptable for centres to provide candidates with a risk-assessment form, including headings, for completion.
- In their Results section pay attention to the number of decimal places to which results are recorded – this was often inconsistent. A significant number of candidates omitted units from graph axes and the use of software to produce graphs can produce poorly-scaled graphs with insufficient coordinate lines to allow them to be read with any degree of accuracy.
- In their Conclusions reach findings which were not vague and gave little consideration to the evaluation of the method in terms of limitations and errors. Suggest refinements or improvements for future investigations and refer with confidence to the terms accuracy, precision, and repeatability/ reliability.

It should be said that a significant number of candidates scored within the lowest Mark Band for their conclusions across the Learning Outcomes.

Assessment and Award of Marks

Across centres the majority of the Teacher assessment and award of marks was appropriate and the assessment objective mark criteria for this unit were well matched to the quality of the candidate response. Centres had successfully used the updated Portfolio Checklist/ Candidate Mark Record. The use of these documents ensured that Teachers and Candidates could easily evidence the presence of all the Learning Outcomes associated with this unit and indicate where and in which band marks had been awarded. Teachers were slightly lenient in their marking of introductions across the Learning Outcomes where no reference or links had been made to the investigation objective and the expected findings. Likewise in procedures where once again across the Learning Outcomes 8 marks had been awarded but there was no Teacher annotation indicating safe and skilful carrying out of the experimental technique procedure in question.

On the whole centres and candidates had worked very conscientiously to meet the portfolio requirement, mark fairly and provide solid portfolio evidence.

Chief Examiner's Report

Assessment Unit AS 2 Human Body Systems (SZ021)

This paper provided candidates with a range of abilities the opportunity to achieve marks in each of the seven questions provided.

Given the overall spread of marks it is clear that the candidates found the paper somewhat challenging. However, it is also clear that a significant loss of marks was due to the inability to recall information.

Candidates of all abilities achieved most marks for Questions 1, 2 and 4. In addition, most candidates successfully gained marks from the mathematical content of the paper. Candidates of all abilities found Question 6 challenging, while marks gained for Question 7 reflected the understanding of individual candidates. With very few exceptions, candidates also achieved the mark for quality of written communication.

- Q1** (a) This was answered well. The majority of students were able to recognise the symptoms of deficiency. For Part (iii) and Part (iv) the most common incorrect answer was a reference to supplements.
- (b) This was not answered well, most candidates were able to identify 1-3 long-term health effects of alcohol, however, fewer were able to explain how alcohol caused these effects.
- Q2** (a) (b) These were answered well by most candidates, however, evaluating the difference in total energy between daily intake and recommended daily intake was commonly missed.
- (c) (i) Very few candidates were able to correctly recall the normal cholesterol levels for a healthy adult.
- (ii) This question was answered very well.
- Q3** (a) (i) The vast majority of candidates were unable to recall information on thyroxine regulation and function.
- (ii) Only a few named the hormones but had them in the wrong order. Most candidates were able to name the thyroid gland for Part (iii).
- (b) This part was answered poorly, reflecting a lack of understanding of negative feedback. Many candidates said about causing more of the hormone to be released. By contrast, the calculation in (c)(i)-(ii) was generally completed correctly.
- Q4** (a) This was generally answered well, with most candidates scoring 3/4 from indicative content so gaining a total of 4 marks. Very few discussed muscle strengthening activities. Many failed to describe spreading vigorous physical activity throughout the week.
- (b) In general, this part was well attempted, with most candidates achieving 4-6 marks.
- Q5** A significant number of candidates were unable to recall information on the structure of the heart (Question 5 (a) and (b)).
- (b) (ii) This proved to be particularly challenging. Many candidates drew arrows incorrectly.
- (c) This was reasonably answered by most candidates.
- (d) This part was very poorly answered by a significant number of candidates.

- Q6** Candidates clearly have not shown understanding of the Bohr effect and how this modulates the unloading of oxygen. Most answers given were of GCSE standard and not of the detail required for AS.
- (a) (i) Some were able to describe the role of haemoglobin.
 - (ii) Only a minority of candidates knew the role of a buffer in the blood and Part (iii) were able to state the normal pH range of blood.
 - (b) (i) (ii) They were generally answered well, as most candidates could read results from the graph, however, a significant number of candidates did not achieve marks for Question 6 (b)(ii).
 - (iii) Overall this was poorly answered, with most candidates achieving only 1 mark.
 - (d) Most candidates achieved one mark, generally by being able to name chemoreceptors/receptors or by describing an increase in breathing rate.
- Q7** Candidates seem to have a better understanding of the process of respiration, compared to the answers given for the comparable question from Summer 2017.
- (a) (i) The majority of candidates were able to describe another process.
 - (ii) Most were able to describe the process of glycolysis and the number of ATP formed and that pyruvate was the end product.
 - (b) (i) This was very poorly answered. A few candidates got 1 mark for saying about no ETC linked to the number of ATP. Question (b) (ii) was well attempted with many gaining 2 marks.

Assessment Unit AS 3 Aspects of Physical Chemistry in Industrial Processes (SZ031)

This examination paper allowed candidates of all abilities to access at least parts of each question. In general candidates seemed confident in attempting all question parts, with very few blank responses. Candidates should be encouraged to use scientific language in all their responses and use legible handwriting. It is helpful in awarding part marks, if calculations are laid out in a logical manner.

- Q1** This question centred on the use of catalysis in car exhausts. Part (a) which asked for the definition of a catalyst was well answered, however candidates must ensure that it is clear in their response that the catalyst remains unchanged at the end of the reaction. In Part (b)(i) labelling the y-axis of the Maxwell-Boltzmann curve was again well known, candidates should note that it is the number not amount of molecules/particles. In Part (ii) the definition of activation energy was very well answered. In Part (iii) the majority of candidates failed to reference the distribution curve and so failed to score any marks, this was also the case in Part (v).
- Q2** This question was based on batch and continuous processes in the production of a chemical. The major reason for candidates not scoring well in Part (a) of this question was in the expression of their answers. Candidates should note that vague answers such as 'cost' and 'efficiency' will not gain any credit. In Part (b) candidates were asked to describe two factors that should be considered regarding waste management when choosing a production plant site, again vague answers such as 'pollution' did not gain credit. It should be noted that candidates should focus on statements in bold font in the question, in this case 'waste management' and should formulate a response on this basis. Candidates on some occasions described the same factor twice, for example the answers 'sewage treatment' and 'river pollution' were taken as being similar responses and so were the same marking point.

- Q3** This question examined the area of enthalpy change. In the majority of scripts, the definition in Part (a) was well known. In Part (b)(i) only a small number of candidates were able to express articulately the experimental method to find the enthalpy change of combustion of ethanol and so gain full marks. Many candidates described the wrong experiment, for example the enthalpy of neutralisation, and so were unable to gain more than three marks for stating the required measurements. Many candidates also provided a confused method, for example adding the ethanol to the calorimeter and so again were only able to access the marks for taking measurements. Surprisingly, in Part (ii) only a small number of candidates were able to state the meaning of all of the symbols in the equation; the most common mistake was stating that 'm' was simply the mass, rather than the mass of water. Part (iv) involved a calculation involving average bond enthalpies, this was well answered, with many candidates scoring full marks. It is important that candidates lay out calculations in a logical order, this assists examiners in giving candidates, who do not calculate the correct final answer, at least partial marks.
- Q4** This question was based on the Contact process. In Part (a)(i) many candidates did not state the full name of the catalyst, leaving out the oxidation number. In Part (a)(ii) the most common error was to state that a heterogeneous catalyst is in a different state to reactants and products. In Part (a)(iii) the name and process of chemisorption on most occasions was not known in sufficient detail to gain full credit. A large number of candidates used the word 'absorb' rather than 'adsorb'. In Part (b) the definition of dynamic equilibrium was only partly known by many candidates, whilst they knew that the forward and backward reaction occurred at the same rate, they failed to gain the second mark for stating that the concentration of reactants and products remained constant. In Part (c)(i) the candidates needed to highlight the negative value of the enthalpy change to gain credit, simply stating -196kJmol^{-1} did not make it clear the candidate understood the concept of an exothermic reaction. In Part (c)(ii) the energy level diagram was well attempted; the most common error was to label the y-axis as 'enthalpy change' rather than just 'enthalpy'. In Part (d) candidates were presented with data about the conditions of an equilibrium reaction and asked to comment on the chosen conditions, this allowed most candidates to score at least some of the four marks.
- Q5** The titration question seemed challenging to candidates mainly in the calculation sections, although most candidates did attempt them. The definition of standard solution in Part (a) was known by most candidates. In Part (b)(ii) and Part (iii) candidates seemed confused about the terms accuracy and reliability and on occasions mixed up their responses or simply stated that titrations should be repeated for both parts. Surprisingly Part (c) was poorly answered showing many candidates could not recall the colours of indicators in acid and alkaline solutions despite there only being two indicators named on the specification. Candidates should note that clear is not equivalent to colourless.
- Q6** The final question on the paper proved to be discriminatory. Whilst most candidates were able to recall Hess's law in Part (a), some wrongly stated the Principle of Conservation of Energy instead. Part (b)(i) proved challenging to candidates and predictably showed lack of understanding of this difficult concept. In Part (b) (ii) examiners applied an 'error carried forward' from Part (b)(i), this meant that candidates who did not correctly answer Part (i) were still able to gain credit in Part (ii). The final part of the question, Part (c), involved constructing a balanced symbol equation which was a challenging task for most candidates, many were unable to deduce the correct formula for calcium hydroxide.

Principal Moderator's Report

Assessment Unit AS 4 Brain Science (SZ041)

The moderated work showed that candidates and their teachers seem to have a good understanding of the breadth and depth needed to meet the submission requirements for this unit on Brain Science. The work showed a good range of marks within and across centres.

Portfolio Requirements

The Submission Criteria as listed in the specification do not allow all learning outcomes to be addressed, however the use of the Candidate Mark Record (updated for this series) seems to have rectified any concerns that were evident in the 2017 series.

The use of the standard laboratory report proforma given in the SAMS allowed candidates to ensure they met all the requirement to access the top mark band in their investigative work.

Learning Outcomes and Assessment Objectives

The majority of candidates in all centres evidenced all the learning outcomes required in this unit. Many centres addressed the Section 4.5 (Research methods) by incorporating the learning objectives into their investigations where appropriate. This seems to have reduced the work load somewhat in this series. Those learning outcomes (in Section 4.5) that do not naturally fall into the investigations should be addressed separately.

The majority of candidates had carried out extensive research using a variety of sources, which were referenced in the bibliography – a small number of candidates, however, provided no indication of sources used.

Assessment and Award of Marks

The use of the Candidate Mark Record appears to have assisted teachers in the application of the mark criteria. Most centres seem to have grasped the detail required to access the top mark band. Where marking was lenient it was primarily in the investigations, particularly in the awarding of Mark Band 4 to investigations where there was no evidence that the candidates could draw conclusions based on their findings or evaluate the method/s they had used. These are difficult skills and candidates need to be given opportunities to develop them in the classroom/laboratory.

Overall, it was evident that centres and candidates had worked diligently to generate evidence towards supporting the achievement of the large number of LOs within this Unit. Assessors had accurately assessed candidate evidence using the mark criteria and Candidate Mark Record and had provided detailed annotation to justify the marks awarded.

Chief Examiner's Report

Assessment Unit AS 5 Material Science (SZ051)

- Q1 (a) (i)** Almost all candidates knew that protons and neutrons are to be found in the nucleus.
- (ii)** Most candidates appreciated that the charge on the proton and the electron were of the same magnitude and of opposite sign. Weaker candidates appeared not to realise that a neutral atom contained equal numbers of each.
- (iii)** Many appreciated that the structure of the atom was (2,8,5) and were able to complete the diagram successfully.
- (iv)** Some candidates appeared not to appreciate from the electronic structure that this was the electronic structure of a non-metal.
- (b)** The description of the mechanism of heat transfer in a metal was poorly done. Many appreciated that a metal has delocalised or free electrons. Fewer understood that they absorb kinetic energy and then move randomly and rapidly through the metal, colliding with lattice ions and imparting to them some of their kinetic energy.
- Q2 (a) (i)** The equation for conductivity was not well known by many of the candidates.
- (ii)** This question required candidates to recall the unit for electrical conductivity. It was good to see so many attempt to use their equation to deduce an appropriate unit.
- (b)** Most candidates scored poorly in this part of the question. Examiners had the impression that some had not done the experiment to measure conductivity. The responses were, in the main, merely repeats of phrases used in the question. In many cases candidates knew the measuring instruments required but omitted to indicate what they were used to measure. A common error was to claim that a micrometer is used to measure area, when in fact it is used to measure a wire's diameter, from which the area is calculated.
- Q3 (a)** Most candidates could identify some features on the graphs, but it was a rare student who obtained the maximum 3 marks.
- (b)** Similar calculations on Young Modulus appeared on the 2017 paper. However, many candidates were unable to do the basic arithmetic and powers of 10 errors were very common. Many appeared to have had limited practice in the use a scientific calculator. While in Part (iii) the extension of the supporting rod is of the order of micrometres, answers of the order of tens of metres were not uncommon. Candidates should be encouraged to check whether their answers to mathematical questions make sense. Notwithstanding all of that, candidates were given full credit for errors carried forward from Part (i) to Part (ii) and from Part (ii) to Part (iii).
- Q4 (a) (i)** This straightforward calculation on density was generally well done.
- (ii)** The key to doing this question was in the instruction to find the volume of the mixture first. Those who did that correctly usually went on to obtain the second mark.

- (iii) This was often poorly done because candidates failed to recall that there are 106 cm³ in a cubic metre. Some gained credit because they recalled that 1 g cm⁻³ is equivalent to 1000 kg m⁻³.
- (b) This was quite well answered although the descriptions in Part (ii) often amounted to a single word. Part (iii) should have been straightforward knowledge recall but again this was not fully answered by the majority.
- (c) This was well answered by most candidates.
- Q5** (a) The differences between thermoplastics and thermosets are quite well known. The explanation of these differences is less well understood.
- (b) Everyday uses for thermosets and thermoplastics appear to be quite well known.
- (c) (i) The difference between polarised light and unpolarised light was hardly known by any of the candidature.
- (ii) Only a very small number of candidates linked the use of a polarising light microscope to crystallography.
- Q6** (a) Most candidates knew the metals used in some of these common alloys. It was an exceptional candidate who knew all three.
- (b) (c) Parts (b) and (c) of this question were very well answered.
- Q7** (a) These questions were well answered by many candidates.
- (b) The use of carbon nanotubes in healthcare was not as well known by the candidature as examiners had anticipated. Candidates scoring full marks in this part were rare. Answers were frequently very vague and non-specific.
- Q8** This question on the PN junction diode was poorly answered. While knowledge of doping was known in Part (a), what happens to the depletion layer in reverse bias was not well understood.

Principal Moderator's Report

Assessment Unit AS 6 Medicine, Drugs and Clinical Trials (SZ061)

The work produced by candidates was mostly of a high standard, demonstrating a clear understanding of the learning outcomes within this unit. A wide range of marks were submitted by centres providing evidence that the learning outcomes have allowed centres to differentiate between candidates.

Portfolio Requirements

Most centres met all portfolio requirements as stated in the specification. Portfolios were well organised and in a logical manner. It was good to see that centres have used the pro-forma from the SAMs to write-up practical investigations in report 2 – when used correctly this has provided candidates with a good structure. It is important to note that in report 2 candidates are expected to research at least one alternative for completing the bioassay and quantitative analysis. To access marks in the higher mark bands candidates are required to explain both methods and evaluate their effectiveness before deciding on the most appropriate method to use. This information has been provided through last year's report and at Agreement Trials, yet some centres are still awarding near full marks for a screen shot of a method from the internet with no comparison.

Learning Outcomes and Assessment Objectives

It was evident that candidates had completed in-depth research across all learning outcomes, and in the clear majority of centres it was evident that this work had been conducted independently by candidates. All learning outcomes within the specification were well understood and interpreted, however in a few cases a small number of learning outcomes have been misinterpreted by centres. Where misinterpretations have occurred, this has been clearly noted within the TAC6 report.

It is important to note that all learning outcomes within the specification for this unit must be covered and evidenced within the portfolio, where sections are missing candidates cannot be awarded any marks. It is the responsibility of centres to use professional judgement to assess the work of candidates and determine the correct mark band. This level of judgement can be assisted by attending Agreement Trials and making use of the Portfolio Clinic.

Assessment and Award of Marks

All centres made effective use of the updated Candidate Mark Record on the CCEA microsite; this made the moderation process very straightforward and allowed moderators to quickly determine what marks had been allocated to the various learning outcomes within the specification. However, in several centres marks had been totalled incorrectly and this led to students being awarded incorrect marks – in some cases the difference of a grade boundary. It is important that all marks are totalled correctly and checked prior to being entered on the eCRS. As indicated previously, some centres are still having difficulty awarding the appropriate mark band for candidate's work – this has been noted on TAC6's and it is important that centres make use of the various support mechanisms in place. Annotation provided by centres was appropriate and indicated the mark band and learning outcomes associated.

A2 Units: Principal Moderator's Report

In the 2018 cohort of A2 Life & Health Science candidates, which was the first to take the qualification, the samples provided for moderation across the internally assessed units indicated that:

Teachers for the most part had:

- Provided their pupils with suitable and appropriate opportunities by way of experimental and investigative pupil objectives and activities which allowed them to present portfolios of evidence which could demonstrate the achievement of all Learning Outcomes and access all mark bands in the Assessment Objectives for the subject specification.
- Applied the mark criteria correctly and awarded marks commensurate with the quality of the pupil response

Candidates could successfully:

- Make lists of materials and equipment, draw diagrams, present results tables, assemble and produce literature reviews, keep laboratory books and work logs, write investigation reports, case studies and factsheets and produce databases across Units 1, 6, 7, 8, 9 and 10. i.e. they could organise and present information.
- Without Teacher assistance work independently, safely and skilfully in the carrying out of the work indicated in the methods/procedures of the written reports, experimental investigations and laboratory book trials of all the internally assessed units. i.e. they could demonstrate safe and skilful practical techniques.
- Collect data and record observations throughout the portfolio units whether for reviews, scientific investigations or laboratory book trials in Unit 1 Scientific Method, Investigation, Analysis and Evaluation or for investigations and laboratory book entries in Microbiology or Oral Health and Dentistry or case studies and databases in Enabling Technology i.e. Make observations with appropriate precision.
- Candidates were able to select appropriate techniques in their introductions for Unit 1 and identify and use appropriate activities and techniques in their investigations in Units 6 to 10 and across the A2 portfolio units. Candidates could identify and adapt refinements in respect of their work i.e. devise and refine experimental and investigative activities, selecting appropriate techniques.
- Candidate responses did indicate that they were able to competently select and handle their own and others' data in an appropriate way whether that be tables and graphs in Units 1, 6, 7, 8, 9 and 10 or in factsheets, summary observations and reports or work logs. However the interpretation of this information in the higher mark bands was in many instances not indicated, i.e. working independently to select and interpret appropriate information.
- Across the A2 units whether candidates were reviewing literature and the data arising (Unit 1) or using various pieces of monitoring information from their own database (Unit 10) they were mostly able to handle, use and change data from one form to another. Interpretation of this data and information was not always at a high standard as is mentioned later in this report, i.e. translate data presented as prose, diagrams, drawings, tables or graphs successfully from one form to another.
- Candidate responses in the results section across the units demonstrated that they could mostly state trends and patterns but some difficulty arose when translating these trends and patterns into Interpretations, findings or conclusions across the A2 units, i.e. describe significant trends and patterns shown by data presented in graphical or tabular forms.

- For the most part candidates' responses across the units were clear, coherent and fluent and in many instances demonstrated a high level of scientific terminology and specialist terms with few exceptions, i.e. write succinctly, clearly and coherently using specialist terms with appropriate referencing.

Consequently satisfying mark criteria in the Assessment Objectives which allowed access to the higher mark bands in these aspects of the portfolio.

However, when it came to the more challenging assessment objectives of AO2 and AO3 candidates did find it more difficult to access the higher mark bands.

- Whether candidates were justifying an area of research from their literature review in Unit 1 or putting forward a hypothesis in Unit 6 application of knowledge, process, equipment and technique should be evidenced across all the A2 units in essays, written reports, laboratory books, case studies and logs. This was not always present to allow for higher mark bands, i.e. apply skills, knowledge and understanding of processes, techniques and equipment to a range of contexts
- Present across the internally assessed units but frequently lacking in detail and of a generic nature were risk assessments. These showed little application to the particular written report, investigation or piece of research. i.e. carry out risk assessments
- Candidates found it difficult across the units whether it was a written report a factsheet or a review essay to write clear analytical statements of prediction, hypotheses or findings in their introductions, report findings, conclusions, refinements, and evaluations. They could not then access the higher mark bands in these areas i.e. Researching, using primary and secondary sources and analysing and presenting findings from the research undertaken and interpret, explaining, analysing, evaluating and drawing conclusions from their own and others investigative and experimental activities making reasoned arguments;

Teachers and Assessors who will obviously wish to optimise the achievement of their students should take note of the following outcomes of moderation across the internally assessed units of this specification.

- The subject specification indicates that centres must use the Candidate record Sheets.
- The candidate portfolio must evidence the achievement of all the unit Learning Outcomes. This is a requirement of the subject specification and in a number of centres this is not evident or immediately evident.
- Where Candidate Mark Records had been correctly used by centres this was to the advantage of the candidate allowing the centre to identify where marks had been awarded in the portfolio and why they had been awarded. Thus, making clear the mark and mark band.
- Where Portfolio Checklists provided by CCEA or centre designed checklists had been used by centres the candidate could clearly and easily evidence the achievement of all the Learning Outcomes for the unit.
- The setting of appropriate and suitable pupil objectives and activities by the teacher is key to providing candidates with the opportunity to access the full mark range and ensure that evidence is clearly and authentically the candidates' own work.

In summary candidate responses to; organising and presenting information, making precise observations, devising and refining experimental and investigative activities, selecting appropriate techniques, describing trends and patterns from data in tabular or graphical forms and translating data in a variety of a forms from one form to another, resulted in candidates providing portfolio evidence throughout their essays, factsheets, case studies, databases, investigation reports and other pupil activity responses in their; introductions, equipment lists, labelled diagrams, procedures, tables, graphs, statistical analysis etc. which allowed candidates to access the higher mark bands. Whereas candidate responses to; methodical recording, applying skills, knowledge and understanding of processes, techniques and equipment for a range of contexts, carrying out risk assessments, researching and using primary and secondary sources, and Interpreting, explaining, analysing, evaluating and drawing conclusions from their own and others investigative and experimental activities making reasoned arguments, elicited candidate responses in portfolio evidence by way of introductions, literature reviews, investigative findings, laboratory working logs and written report conclusions and evaluations which were not in the higher mark bands.

On the whole it was evident that centres and candidates had worked hard to meet the portfolio submission requirements, produce and present solid evidence and mark fairly and in line with CCEA guidelines.

Support is available in addressing all of the issues raised in this report by way of TAC6 reports to centres, Agreement Trials and Portfolio Clinics. The most up-to-date information and support material can be found on the CCEA Microsite for Life and Health Sciences.

The following Unit-specific comments have been provided by the relevant Assistant Principal Moderators, incorporating feed-back provided by the Moderators in their various teams. The comments are intended to direct centres towards best-practice in the generation of candidate evidence.

Assessment Unit A2 1 Scientific Method, Investigation, Analysis and Evaluation (AZ011)

Portfolio Requirements

The 2018 cohort of candidates was the first to take this unit of the qualification. The majority of centres met the requirement to use the CCEA Portfolio Checklist and Candidate Mark Record (Essay, Planning Laboratory Book and Written Report) for the unit. Most of the candidate portfolios evidenced the compulsory components i.e. a literature review Essay, a Planning and Laboratory Book and an investigation Written Report which for the most part had been produced according to the requested format. However, it is important to also draw to the attention of centres that a small but significant number did not meet the submission requirements because:

- The Essay was not a review of the literature in the field in which candidates planned to carry out their scientific investigation, analysis and evaluation and was not correctly Harvard referenced.
- The Planning and Laboratory Book did not contain an obvious draft plan followed by trials, refinements, a summary of refinements and a final project plan.
- The Written Report did not contain a statistical analysis, was not correctly Harvard referenced and did not contain appendices.

Nevertheless, there was a high quality and standard of portfolio evidence and excellent organisation and presentation of the portfolios sampled in this series in many centres.

Learning Outcomes and Assessment Objectives

On the whole with few exceptions centres had completed the three mandatory pieces of evidence for the unit. Mostly it was clear from the Portfolio Checklist and the presentation of the portfolios that the requirement for all learning outcomes to be evidenced had been met. Each learning outcome was matched in this way to a particular mandatory format eg the essay. In a small but significant number of centres the learning outcomes were not all evidenced or could not be easily located as there was no portfolio checklist. All the learning outcomes associated with 7.1 should have been easy to evidence within the Planning and Laboratory Book by way of a log of learning in these outcomes but unfortunately not all centres opted for this method and achieving these outcomes became incidental or a possible consequence of the other aspects of the evidence. This should be addressed by centres in the coming series. Learning Outcomes 7.2.1 to 7.2.3 were most appropriately evidenced in the Literature Review and the vast majority of centres did evidence the outcomes in this way but a few centres had not produced an essay which was a review of the field of their investigation and in fact in a few instances the essay was not even a review of literature. This error presented a challenge to candidates in their opportunity to access the higher mark range. Candidates were able to organise and present information, make observations with appropriate precision, devise and refine experimental and investigative activities, select appropriate techniques, translate data presented as prose, diagrams, drawings, tables or graphs successfully from one form to another and write succinctly, clearly and coherently using specialist terms with appropriate referencing; this was all evidenced in the report introductions, materials and apparatus lists, procedures, risk assessments and results. Indeed, most candidates were able to easily access the full mark range in these assessment objectives. What did however provide the candidates with a much greater challenge was methodical recording, applying skills, knowledge and understanding of processes, techniques and equipment to a range of contexts, carrying out risk assessments, researching and using primary and secondary sources, and Interpreting, explaining, analysing, evaluating and drawing conclusions from their own and others' investigative and experimental activities having made reasoned arguments. The candidate response to these assessment objectives did not allow them to easily access the higher mark bands. This was evident in the portfolios of even very capable candidates where they could not consistently:

- In their introductions to review essays and investigation written reports state a prediction/hypothesis or expectation of results in which they could relate their findings to their chosen area of research.
- In their Risk Assessments identify the hazard, the risk, and the control measures to be applied, with specific references to COSHH and CLEAPSS where appropriate that were specific to that investigation and the materials and apparatus used.
- In their Results section pay attention to the number of decimal places to which results are recorded and ensure that units are not omitted from graph axes.
- In their Conclusions reach findings which were clear and pertinent with reference to the evaluation of the method in terms of limitations and errors. Suggest refinements or improvements for future investigation and refer with confidence to the terms accuracy, precision, and repeatability/reliability.

It should be said that a significant number of candidates scored within the lowest Mark Band for their conclusions both in their Literature Review Essay and their Investigation Written Report.

Assessment and Award of Marks

Across centres the majority of the Teacher assessment and award of marks was appropriate with Teachers matching the assessment objective mark criteria and band in line with the nature of the quality of the candidate response. Centres had successfully used the updated Portfolio Checklist/Candidate Mark Record. The use of these documents ensured that Teachers and Candidates could easily evidence the presence of all the Learning Outcomes associated with this unit and indicate where and in which band marks had been awarded. Teachers were slightly lenient in their marking of:

- Candidate conclusions in the literature review essay; on many occasions they had not reached a conclusion on their area of investigation based upon their review of others work in the field yet Teachers had awarded middle to high band marks.
- Some learning outcomes where marks were awarded because of inferred evidence rather than actual evidence.
- Draft plans where marks were awarded for plans which were not present in the Laboratory Book but were inferred by the presence of a final plan.
- Conclusions, evaluations, references and appendices which in some instances were not present.

It was evident that on the whole centres and candidates had worked diligently to meet the submission requirements, generate solid portfolio evidence and mark fairly.

Chief Examiner's Report

Assessment Unit A2 2 Organic Chemistry (AZ021)

This paper provided candidates with a range of abilities to achieve marks in each of the six questions, by demonstrating their understanding of organic chemistry, and a range of scores were obtained. It was pleasing to note that some candidates achieved excellent scores on this paper, reflecting a very sound knowledge of organic chemistry and an ability to apply this knowledge. Some very poor responses were also noted, with these candidates scoring few marks in the calculation and quality of written communication questions in particular.

Q1 This question was a gentle introduction, examining the basics of simpler organic compounds. In Part (a)(i) the definition of hydrocarbon was well known, but some candidates made the error of stating that it was 'an element' which contained carbon and hydrogen only. Parts (a)(ii) to (vi) were well answered by most reflecting good understanding of alkanes and alkenes and their structure and formula. It was pleasing to note that many candidates drew the skeletal formula correctly in Part (vii), however the drawing of the structural formula of a branched isomer and naming it proved more challenging. Candidates need to read questions carefully as many identified the type of reaction – hydrogenation in Part (ix) rather than giving the name of the reactant. Almost all were able to write a balanced symbol equation for the combustion of A in Part (b) (i), but fewer were able to correctly name all the incomplete combustion products, many incorrectly citing hydrogen as a product. The toxicity of carbon monoxide was the most common correct answer for Part (b) (ii).

- Q2** Candidates need to be careful with their language when explaining what is meant by a homologous series, as many incorrectly stated that the compounds in the series had the same, rather than similar chemical properties, and similar physical properties rather than a gradation in physical properties. Only better candidates correctly named the type of reaction in Part (b)(i) and gave a correct equation in Part (b)(ii), though most were able to deduce that the reaction needed light in (iii). Note that the mechanism for this reaction is not expected. It was disappointing that most were unable to coherently explain the process of fractional distillation, and few referred to separation being due to difference in boiling points. Part (c)(ii) required candidates to work out the equation and name the product and this was quite well answered. Most candidates obtained the mark in Part (c)(iii) showing that they have a good grasp of drawing organic structures. Parts (d) focused on environmental aspects of burning petrol and there were varying degrees of success. Most answered Parts (i) and (ii) correctly but few obtained mark for the equation in (iii) due to a failure to realise that nitrogen is diatomic. Most candidates scored well in Part (e) on biofuels.
- Q3** This question tested knowledge and understanding of the alkenes. Candidates must ensure that they read the question carefully. In Part (a)(i) most described how sigma and pi bonds formed, rather than focussing on the explanation of how they enabled alkenes to undergo addition reactions. Some excellent mechanisms were drawn in Part (a)(ii) but the majority of candidates were very careless when drawing curly arrows; curly arrows should touch the bond, and the lone pair on the bromide ion should be shown. Pupils were able to name at least part of the mechanism and some were able to correctly name the compound. In Part (b) many understood cis and trans and obtained one mark, but only better candidates could correctly draw the isomers of hex-2-ene. There were problems in understanding in Part (c), many thinking the polymer was called polyethane and drawing it with a double bond.
- Q4** Overall this question was poorly answered. Correct definitions of structural isomer were not often seen in Part (a) and few scored marks in Part (b). There was variation between centres for Part (c) and some students gave exacting detail of measurements of chemicals and techniques of reflux rather than focusing on a simple test tube experiment to distinguish between these alcohols. Many did not link the correct colour changes to the correct type of alcohol, nor did they identify pentan-2-ol as secondary and 2-methylbutan-2-ol as tertiary. It was notable that many students left this question blank. The calculation in Part (d) was attempted by most and many scored at least two marks.
- Q5** Naming the substances in Part (a) proved difficult for most. It should be noted that in Part (b) red-brown is not accepted for the colour of bromine water; orange/yellow/brown is the correct colour. Some did add Benedict's solution to test for pentanal but only a minority mentioned heating it. Classification of C as primary in Part (d) was the best answered part of this question. In Part (e) the common error was to state propanol rather than propan-1-ol.

Q6 It was evident that pupils were in the main familiar with the preparation of aspirin in the laboratory though most did not give a correct comprehensive answer which included purification. Again, too many tried to give exact volumes and measurements. The actual method of recrystallization by dissolving in the minimum volume of hot solvent, filtering hot and cooling was not well known – complete centres made errors in dissolving the solid in a fixed volume e.g. 20 cm³ of solvent. Again, students misinterpreted the purification of the sample by describing how they would add ferric chloride to test purity, rather than describing the purification steps. Candidates should be taught how to dry aspirin correctly either between sheets of filter paper, in a low temperature oven or in a desiccator. It was disturbing to note the number of candidates who used an incubator. Part (a)(iii) saw candidates gain some marks for either ferric chloride addition or melting point determination, however full marks were not often awarded. It is important to note that candidates may have to give answers to a given number of decimal places or significant places, as in Part (b). Most candidates were unable to do this. Most however did attempt and score some marks for the percentage yield calculation.

Assessment Unit A2 3 Medical Physics (AZ031)

Question 2 and 3 (a) were more accessible to the weaker candidates but there was good discrimination within all questions. Calculation questions were answered worse than the written questions. It was fairly common for students to lose marks on the recall/definitions type questions. Many candidates knew approximately what they were talking about but didn't use accurate enough terms.

- Q1** It was disappointing that not all candidate could recall the frequency ranges requested in both Part (a) and (b). The majority of candidates could correctly Answer 1 (b) (ii) and Question 1 (b)(iii) as they were straight recall. The calculations in Question 1 (c) were either completed well or very poorly. Not all candidates could recall the equations required to answer each part. In Question 1 (c)(ii), most candidates did not attempt to calculate the specific acoustic impedance of air and instead substituted a value taken directly from the table. Lack of working out and equations were an issue which caused candidates to lose marks unnecessarily. Most students were able to identify that the ultrasound would be strongly reflected at the air tissue boundary and that gel is used to prevent this. Most candidates were able to answer Question 1 (c) (iv) although a few incorrectly suggested organs such as the heart and liver.
- Q2** Question 2 (a)(i) was not well answered, with most students scoring 1 or 0. Question 2 (a)(ii) was generally very well answered. Candidates provided well structured, very detailed responses. Question 2 (b)(i) candidates did not know suitable values and often provided only 1 number. Question 2 (b)(ii) was well answered with most candidates able to provide at least 1 of the points on the mark scheme.
- Q3** Question 3 (a) this was very well answered by most candidates. Although in Question 3 (b)(i) some candidates provided a sketch of a single fibre rather than a basic diagram of an endoscope. Question 3 (b)(ii) despite being a straight recall question, students did not seem well prepared for this question. The critical angle was often discussed but not total internal reflection. The descriptions of coherent and non-coherent were weak.

- Q4** Question 4 (a) many candidates scored well in Question 4 (a)(i) and (ii), however they didn't always read over their answers to ensure all points were included. In Question 4 (b), stronger candidates did well in this question. In Question 4 (b)(i) most students answered correctly. Question 4 (b)(ii) students often wrote any medical condition that affected the brain rather than one which could be diagnosed by use of an EEG. Question 4 (b)(iii) few students gained full marks as they discussed aspects of the waveform but were not able to identify what made them different. Question 4 (b)(iv) many candidates were able to correctly identify the use of electrodes or measurement of electrical activity.
- Q5** Question 5 (a)(i) the definition of half-life was not well communicated. The term activity was not used, and this led to vague answers. Question 5 (a)(ii) some students seemed to make no attempt at this straightforward calculation. A mistake made by most was to leave the time in hours rather than converting into seconds. Question 5 (b)(i) The majority of students discussed how to prepare a sample of protactinium rather than discuss how data was to be collected. The Geiger tube was usually mentioned, but not a stop watch. Question 5 (b)(ii) this graph was not well recalled. Most scored 1 mark for a curve in the correct sense, but not enough care was taken to clearly draw what the shape of the curve was like as it approached the axes. Question 5 (b)(iii) was also not well known despite being straight recall.
- Q6** Question 6 (a) students were usually aware of what background radiation was, but not how to calculate it from a range of readings. Most knew that 10 seconds was too short a time interval but couldn't fully explain why. Question 6 (b) quite a few candidates were able to clearly answer this question.
- Q7** Weak students were not able to access many marks in this question, however strong candidates performed well. Candidates were often unable to choose a correct equation from which to start. They often did not look at the units of the decay constant (s^{-1}) and time (in minutes). Even if they could identify a correct equation and make substitutions, they often could not complete the calculation. Part (iii) was a straight recall question, which again, was not well learned.
- Q8** This question required students to synthesise their knowledge of alpha, beta and gamma radiation in its diagnosis and treatment of cancer. Students often failed to identify the key properties of each type of radiation in this context and were not able to apply their knowledge to identify the radiation types in the table. Students often gave more than one type of radiation for each answer which scored no marks.

Assessment Unit A2 4 Sound and Light (AZ041)

Questions 1-3 were more accessible to the weaker candidates but there was good discrimination within all questions. Calculation questions were answered worse than the written questions. Stating equations and providing working out was often an issue that cost students unnecessary marks. It was common for students to lose marks on the recall/definitions type questions. Many candidates knew approximately what they were talking about but didn't use accurate enough terms

- Q1 (a)** Most candidates were able to access this question, they were able to successfully recall which waves were transverse and which were longitudinal and which waves were electromagnetic, however Part (iii) was not well answered as candidates stated features which, whilst being features of electromagnetic waves, were not unique. Candidates also stated 2 features for a single answer which could only score 1/2 as there was 1 mark each for answer 1 and 2.

- (b)** Candidates could identify the amplitude but had difficulty calculating its magnitude from the scale. Most candidates could identify the time period, but there were power errors when calculating the frequency. There was an ecf awarded in Part (v) for frequency, however, most candidates failed to notice that wavelength was given in cm and speed was required in ms⁻¹.
- Q2 (a)** Was generally well done with most sketches being correct and well annotated. Candidates struggled with the rest of this question and were not fully able to describe the data to be collected. Most scored only 1/2 for the graph labels. A common error was suggesting that the two values to be plotted were wavelength and frequency.
- (b)** Unfortunately most students were unable to identify the signal generator as the piece of equipment in Part (i). The node and antinode positions were well answered along with the wave pattern for the first harmonic. However, many candidates were unable to calculate the wavelength.
- (v)** Was poorly answered, very few were able to identify that when resonance is observed, the amplitude is greatest.
- Q3 (a)** This straight recall question was not well answered by candidates.
- (b)** Most candidates scored highly in this question. The points which were left out by many were those relating to the oval window and the cochlea.
- Q4 (a)** This was a straight recall question and, again, not as well answered as it should have been.
- (b)** The unit for intensity was not well known.
- (c) (d)** These parts were either very well done or poorly done. Candidates were usually able to provide a suitable equation but were unable to complete the calculation correctly.
- (e)** Both parts were poorly answered, with candidates often discussing frequency rather than addressing the question which was asking about intensity.
- Q5 (a)** Many candidates scored well in Part (i), however unlabelled sketches could not access many marks. Most candidates could recall an advantage or a disadvantage of single mode fibres but not recall uses.
- (iv)** Was difficult and candidates failed to score because the peak amplitude was too high.
- (b)** Many candidates did not do well in this question. They did not read the question carefully and missed very simple marks relating to energy changes that take place. Quite a few candidates incorrectly suggested the use of satellite dishes rather than dipole aerial and antenna.
- (c)** Most candidates picked up at least 1 mark in this question for stating a use of Bluetooth, however, some statements were so short and vague that no marks were awarded. Students must become more aware that a 1-word answer is not a sufficient description.
- Q6 (a)** Many candidates scored some marks in this question, Part (i) was quite well answered, Part (ii) students described how they would calculate focal length but did not continue to describe how they would calculate power.
- (b)** This calculation was poorly attempted, again pupils were unable to distinguish clearly between focal length and power, which caused them to include unnecessary steps in their calculation. The algebra caused problems along with the units.

- (c) The lens type was well known; however, the calculation was not well attempted. Students did not seem to be aware that the image created was virtual and required a negative sign. Also, there was confusion with units.
- Q7** (a) This was also one of the lowest scoring questions on the paper. Students were not able to shade the correct region on the graph, often scoring 0/2. Part (ii) was poorly answered and Part (iii) was a straight recall question, was also poorly answered. Again, in these style of short response questions, the answers are too vague and too short. Part (iv) most candidates were able to state that the sound heard would be louder but did not access further marks. Some were unaware that an increase in the number of decibels would produce an increase in loudness.
- (b) Quite a few candidates were able to clearly answer this question.
- (c) Students were able to recall material relating to this question, however, didn't always fully understand what they had learned.

Assessment Unit A2 5 Genetics, Stem Cell Research and Cloning (AZ051)

This paper provided candidates with a range of abilities the opportunity to achieve marks in each of the nine questions provided. Candidate responses ranged from poor to excellent, with most candidates attempting to answer all parts of every question on the paper. Some obtained high marks displaying a sound grasp of the subject content and well-developed skills in application. Some candidates lost marks due to not addressing the question(s) entirely whilst a small number of candidates did not read the question(s) carefully enough, failing to address the question(s).

- Q1** (a) Many candidates gained full marks in this question part. However, a small number of candidates failed to identify point two.
- (b) Most candidates were able to describe at least one way in which meiosis produces genetically different cells. However, many candidates were unable to provide a further description of their answer for the second point. Many candidates do not understand how crossing over and independent segregation creates genetically different cells in meiosis. A small number of candidates were able to gain full marks, which is very pleasing.
- Q2** (a) (i) The majority of candidates completed this question correctly. Some gave sugar or pentose sugar for part B which was too vague.
- (ii) A significant number of candidates were able to identify all three types of RNA correctly.
- (b) (i) Many candidates were able to link Watson and Crick's three-dimensional double helix model to Chargaff's rule for nitrogenous bases.
- (ii) The majority of candidates scored full marks in this question. However, a small proportion of candidates confused the percentage of bases found in human DNA with those in rat DNA.
- (iii) Many candidates were able to give a reasonable suggestion for the difference in base composition of the viral DNA. Candidates who did not answer Question (b) Part (i) correctly generally failed to gain a mark in this question, demonstrating a lack of knowledge and understanding.

- Q3 (a) (i)** A significant number of candidates were able to identify each type of stem cell.
- (ii)** Candidates gave a range of responses in this question. Some were able to suggest bone marrow however a significant number incorrectly suggested blood.
- (iii)** Many candidates do not understand how stem cells are stimulated to differentiate.
- (b) (i)** The majority of candidates were able to explain two unique properties of stem cells in medicine, demonstrating a clear understanding of the use of stem cells.
- (ii)** Many candidates demonstrated a clear understanding of the ethical issues raised through the use of stem cells.
- Q4 (a) (i)** The majority of candidates identified the pancreas as the location of insulin production. Some candidates described the Islets of Langerhans whilst others were even more specific describing β -cells in Islets of Langerhans, this was very pleasing.
- (ii)** The majority of candidates were able to correctly calculate the number of bases in this question. A small minority of candidates incorrectly divided the total number of amino acids by three instead of multiplying by three. However, these candidates correctly calculated the total number of amino acids and gained one mark.
- (iii)** This question was relatively straightforward, requiring recall of the production of Humulin using genetic engineering. The vast majority of candidates scored well with a significant number gaining full marks. Many candidates demonstrated a clear understanding of the process and were able to name the enzymes involved.
- (iv)** Most candidates were able to gain full marks in this question, successfully giving advantages of using insulin from genetically modified organisms rather than from animals.
- (v)** This question was more poorly answered. Many candidates failed to link the number of amino acids in their answer. Some candidates gave vague answers such as pig insulin is more similar to human insulin. It was pleasing to note that some candidates demonstrated a clear understanding of the question giving clear suggestions.
- (b) (i)** This question is familiar to candidates and overlaps with AS 2: Human Body Systems. It is surprising that a significant number were unsure of how insulin regulates blood glucose levels. Many candidates did not know that insulin lowers blood glucose, this was very disappointing.
- (ii)** Many candidates correctly calculated the percentage increase in people with diabetes. Candidates should be encouraged to show their working out.
- Q5 (a) (i)** Only a minority of candidates were able to describe how DNA differs from one person to another marking each of them unique.
- (ii)** Most candidates were able to identify restriction endonucleases/enzyme. Those who did not, named enzymes such as DNA polymerase, ligase and helicase.
- (iii)** This was a very discriminating question. A small number of candidates scored one mark and only those of the highest ability obtained two marks.

- (b) (i)** The majority of candidates identified Gel Electrophoresis.
 - (ii)** The majority of candidates identified suspect B correctly. Most candidates then were able to give a sufficient explanation for their choice. A small number gave vague explanations.
 - (iii)** Most candidates correctly suggested a reason that could be used to discredit the evidence produced by the process of genetic fingerprinting.
 - (iv)** Many candidates were able to give one other use of genetic fingerprinting. This demonstrates a good understanding of its application.
- Q6 (a)** The clear majority of candidates were able to give the correct genotype. A small number of candidates incorrectly placed an allele on the Y chromosome. Candidates should be encouraged to read the question fully.
- (ii)** Provided candidates with the opportunity to use a Punnett square, interpreting and predicting results involving sex linkage. Many candidates scored full marks.
 - (iii)** Many candidates were able to correctly identify the same probability as in Part (ii).
 - (iv)** Most candidates explained why males are more likely to have haemophilia than females.
- (b)** Candidates demonstrated clear understanding of the advantages and disadvantages of genetic screening. A small number confused this with ethical issues surrounding the use of stem cell research.
- Q7 (a) (i)** This question was answered very poorly. A small minority of candidates answered correctly.
- (ii)** Many candidates failed to link shortness of breath to an increased diffusion distance. This is disappointing considering the overlap with AS 2: Human Body Systems. More candidates were able to link chest infections to the trapping of bacteria.
 - (iii)** The majority of candidates could not correctly name another body system affected by cystic fibrosis. Many candidates incorrectly described the circulatory system. It was surprising that a small number of candidates described the respiratory system when this was already discussed in Part (ii).
- (b) (i)** This question was generally well answered with a range of marks obtained. Most candidates were able to identify the introduction of a healthy/normal (CFTR) gene. Others were able to describe fully how gene therapy may be used to treat respiratory systems in a person with cystic fibrosis.
- (ii)** Most candidates identified why the technique of gene therapy is of limited use.
- (c) (i)** The majority of candidates correctly identified the 10-year period with the biggest increase in survival age.
- (ii)** Most candidates gave a reasonable suggestion for the increase in survival age.
 - (iii)** Most candidates were able to use the graph to identify the expected age. A small number clearly did not use a ruler to extrapolate the graph and as a result lost marks due to incorrectly identifying the age.

- Q8** (a) (i) Most candidates gave the correct genotype, whilst some candidates failed to realise there were two alleles for each characteristic.
- (ii) Most candidates gave the correct genotype, demonstrating understanding of the term heterozygous.
- (b) (i) This question was answered well by most candidates. A very small number of candidates couldn't work out the gametes and so lost all four marks.
- (ii) The majority of candidates were able to identify the phenotypes as 9:3:3:1. A small number incorrectly calculated the proportions; this was mostly caused by candidates incorrectly interpreting their handwriting as a large or small letter, particularly for wing shape.
- (c) (i) This question required candidates to calculate a Chi square value, using data presented in a table. The majority of candidates successfully calculated the value. A small minority of candidates completed the table correctly but failed to calculate the Chi square value correctly.
- (ii) Most candidates identified three degrees of freedom.
- (iii) Most candidates were able to give the range of probabilities for their Chi squared value correctly.
- (iv) This question proved to be very discriminating. Some candidates gained one mark whilst only those of the highest ability gained the second marking point. It is apparent that candidates can successfully calculate Chi squared, identify degrees of freedom and obtain the range of probabilities but fail to determine if the observed data fits the expected ratio.
- Q9** This question produced a full range of responses from the candidates. Some candidates achieved full marks. The quality of written communication was generally very good. Terms such as semi-conservative replication, DNA helicase, DNA polymerase and condensation reactions are well known and understood by the candidature. A small number of candidates confused DNA ligase with DNA polymerase. A number of candidates confused DNA replication with transcription and translation. A smaller minority included a description of PCR.

Principal Moderator's Report

Assessment Unit A2 6 Microbiology (AZ061)

The moderated work showed that candidates and their teachers seem to have a good understanding of the breadth and depth needed to meet the submission requirements for this unit on Microbiology. The work showed a range of marks within and across centres.

Portfolio Requirements

The submission criteria requires candidates to write up their investigations in accordance with the standard laboratory report guidelines, a proforma for this can be found in the SAMS.

Candidates are also required to Harvard reference, whilst some candidates did this very well this is an area that should be developed across all centres in future submissions.

The lab book took various forms in different centres. Candidates should be aware that this is a working document and does not need to be neatly presented for them to access the full range of marks. This is a good way to evidence those practical learning outcomes that do not form part of their investigative work.

Learning Outcomes

The majority of candidate portfolios sampled evidenced all the learning outcomes required in this unit.

Most candidates had carried out extensive research using a variety of sources, which were referenced in the bibliography – a small number of candidates, however, provided no indication of the sources used.

Assessment and Award of Marks

The candidate mark record will be amended for the 2019 series to allow assessors to award marks for each of the practical investigations separately. Most centres seem to have grasped the detail required to achieve at each mark band in all Assessment Objectives. Again, some leniency is seen in the marking of AO3(i) which requires candidates to interpret results in a rigorous way and to draw conclusions based on their findings. Conclusions were generally brief and lacked the scientific language/detail needed to award marks in the higher mark band. The evaluations were also lacking the detail required for Mark Band 4. Evaluations should be reflective of the method they have detailed in their planning and should suggest refinements in order to be awarded marks Mark Band 4.

Overall, it was evident that centres and candidates had worked diligently to generate evidence for this unit. Assessors had accurately assessed candidate evidence using the mark criteria and Candidate Mark Record, and had provided detailed annotation to justify the marks awarded.

Assessment Unit A2 7 Oral Health and Dentistry (AZ071)

The moderated work showed that candidates and their teachers seem to have a good understanding of the breadth and depth needed to meet the submission requirements for this unit on Oral Health and Dentistry. A small number of centres submitted work for this unit but the work seen was of a very high standard.

Portfolio Requirements

The submission criteria requires candidates to write up their investigations in accordance with the standard laboratory report guidelines, a proforma for this can be found in the SAMS.

Candidates are required to Harvard reference, whilst some candidates did this very well this is an area that should be developed across all centres in future submissions.

Learning Outcomes

The majority of candidate portfolios sampled evidenced all the learning outcomes required in this unit.

Most of the candidates had carried out extensive research using a variety of sources, which were referenced in the bibliography – a small number of candidates, however, provided no indication of the sources used.

A small number of the learning outcomes posed candidates some difficulty. 13.2.5 asks candidates to investigate practically the role of the salivary glands and other oral glands, including their role in chemical and microbiotic digestion. For the most part candidates could achieve this in relation to the role of amylase on the digestion of starch and lipase on the digestion of lipids. However, investigating practically, the role of haptocorrin in

the binding of B12 or the role of oral bacteria in the processing of nitrates is outside the limitations of a school laboratory and so it is appropriate to research the role of these substances without carrying out the practical element. 13.4.2 asks candidates to compare through practical investigation the main fixed and removable prosthodontics used in dentistry, the dental materials used in their construction and the processes used to retain prosthodontics in the oral cavity. It is sufficient to compare and contrast the types of prosthodontics and how they are retained in the oral cavity. Candidates could analyse why different prosthodontics are used in different circumstances, looking at things like cost, aesthetics, invasive nature etc. An investigation into different dental adhesives could be done here to facilitate the awarding of marks for AO3. Candidates could also do simple materials testing here to look at qualities such as flexibility, strength, hardness etc. for the main dental materials.

Assessment and Award of Marks

The candidate mark record will be amended for the 2019 series to allow assessors to award marks for each of the practical investigations separately. Most centres seem to have grasped the detail required to achieve at each mark band in all the assessment objectives. Again, some leniency is seen in the marking of AO3(i) which requires candidates to interpret results in a rigorous way and to draw conclusions based on their findings. Conclusions were generally brief and lacked the scientific language/detail needed to award marks in the higher mark band. The evaluations were also lacking the detail required for Mark Band 4. Evaluations should be reflective of the method they have detailed in their planning and should suggest refinements in order to award Mark Band 4.

Overall, it was evident that centres and candidates had worked diligently to generate evidence for this unit. Assessors had accurately assessed candidate evidence using the mark criteria and Candidate Mark Record, and had provided detailed annotation to justify the marks awarded.

Assessment Unit A2 8 Histology and Pathology (AZ081)

Very few centres submitted portfolios for this unit during the current academic year. The work that was submitted was of a very high standard, demonstrating that centres had understood the specification well and interpreted the learning outcomes correctly.

Portfolio Requirements

Centres who submitted work met all the requirements of the specification and allowed differentiation of candidates within centres. All learning outcomes were well interpreted and allowed candidates to access the full range of marks. Where practical investigations were conducted candidates made use of the pro-forma provided in the SAMs – this meant that all necessary areas were included within the portfolio.

Learning Outcomes

All tasks set provided the candidates the opportunity to access the range of marks across the specification. It was clear from the evidence provided by candidates, that they had worked independently to research the content in detail and provide the necessary information to meet all the requirements. It has been noted that the wording of some of the learning outcomes in the specification would elude to the fact that only one practical investigation is needed to meet the requirements, however two practical investigations should be completed within this unit of study. Further guidance will be provided on this at the information events in the Autumn term.

Assessment and Award of Marks

The moderation process was made very easy due to all centres submitting candidate mark records, completed correctly. This allowed moderators to quickly identify what marks had been awarded to each of the learning outcomes. All marks were totalled correctly, meaning candidates were not placed at any disadvantage.

Assessment Unit A2 9 Analytical Chemistry Techniques (AZ091)

This optional unit at A2 was selected by many centres during the current academic year. In general, the work submitted by candidates was of a high standard and had been assessed appropriately by centres. It was clear that many centres had understood and interpreted the learning outcomes correctly, with only a small number of centres misinterpreting a few areas of the specification.

Portfolio Requirements

Throughout all investigations and across all centres it was clear that candidates had made use of the standard pro-forma within the SAMs for writing up practical investigations. This meant that in most cases candidates were providing detailed and logical investigations, covering all the necessary components. It would be advised that centres who have not made use of this to access it on the CCEA microsite. At A2 level it is a requirement that candidates use the Harvard referencing system to reference any sources used throughout the portfolio.

Learning Outcomes

Overall, the quality of work submitted by centres was of a very pleasing standard. Portfolios largely evidenced the learning outcomes as presented in the specification. Misinterpretations occurred within the evaluation of each practical investigation, where candidates were not only required to evaluate their procedures and technique, but assess the accuracy and reliability of their results. Such evaluations should be specific to the investigation conducted and suggested improvements should be valid.

Some of the aims/scenarios set by centres did not provided candidates with the opportunity to access the full range of marks available across this unit. It is vital that centres develop and choose appropriate investigations for candidates that allow differentiation between candidates; thus, allowing candidates to access the entire range of marks available.

Most candidates had carried out extensive research using a variety of sources, which were referenced in the bibliography – a small number of candidates, however, provided no indication of their sources used.

Assessment and Award of Marks

All centres made correct use of the candidate mark record available on the microsite, with very few totalling errors. Annotation was appropriate and correct across most centres, indicating the learning outcome and mark band awarded. It was evident that most centres were competent in awarding marks appropriately and differentiated well between candidates. However, it is worth noting that some centres awarded candidates consistently in Mark Band 4, despite the candidate response not meeting the criteria for the award of marks in this band. It is important for centres to use professional judgement when allocating mark bands, in addition to seeking advice at Agreement Trials and through the portfolio clinic. Consistently, the evaluation section of each investigation was awarded Mark Band

4 despite not commenting on the accuracy and reliability of results obtained. Evaluations should be reflective of the method detailed in the planning section by the candidate and should suggest refinements in order to be awarded Mark Band 4.

Assessment Unit A2 10 Enabling Technology (AZ101)

The 2018 cohort of candidates was the first to take this portfolio unit in the qualification. All centre samples met the requirement to use the CCEA Portfolio Checklist and Candidate Mark Record (Candidate Log of Work and Learning) for the unit. All candidate portfolios sampled evidenced the compulsory components i.e. a Case Study and Database for patient Monitoring) which for the most part had been produced according to the requested format. However, it is important to also draw to the attention of centres that it is difficult in this unit to guide candidates to ensure that their portfolios are not simply a huge compilation of internet cut and paste exercises. This can be assisted and in many instances irradiated from portfolios by:

- Providing very clearly structured pupil activities which require the candidates to present their evidence of each learning outcome in particular and varied ways.
- Candidates ensuring that they keep a learning log or diary style evidence format for particular learning outcomes.

Nevertheless, there was a high quality and standard of portfolio evidence and excellent organisation and presentation of the portfolios sampled in this series in many centres.

Learning Outcomes

Overall, the quality of work submitted by centres was of a very pleasing standard. Portfolios tended to evidence learning outcomes 16.1.1 to 16.1.5 and 16.2.1 to 16.2.3 as presented in the specification in the form of factsheets or written reports whereas learning outcome 16.3.1 was assessed in the Case Study and learning outcomes 16.4.1 to 16.4.8 in the Patient Monitoring Database as would have been expected. The only issue that arose in the evidence presented was the need to find with ease the programme/regime of exercise/fitness put in place for patients being monitored. This was sometimes not immediately evident and there were a few misinterpretations within the evaluation of the monitoring data. Finally where the evidence of learning outcome 16.4.9 was the record of a discussion of the pros and cons of sharing and safeguarding patient data the evidence allowed candidates to access the higher mark bands. Candidates throughout this unit had carried out extensive research using a variety of sources, which were referenced in the bibliographies.

Assessment and Award of Marks

Across centres the majority of the Teacher assessment and award of marks was appropriate with Teachers matching the assessment objective mark criteria and band in line with the nature of the quality of the candidate response. Centres had successfully used the new Portfolio Checklist and Candidate Mark Record. The use of these documents ensured that Teachers and Candidates could easily evidence the presence of all the Learning Outcomes associated with this unit and indicate where and in which band marks had been awarded. Teachers were slightly lenient in their marking of :

- Learning outcome 16.1.9 where some candidates had provided little more than a paragraph of assessment of benefits and dangers.
- Learning outcome 16.4.1 where the group size is required to be a minimum of 5 individuals.

It was evident that on the whole that centres and candidates had worked diligently to meet the submission requirements, generate solid portfolio evidence and award marks fairly.

Contact details

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