GCE

Rewarding Learning

Chief Examiner's and Principal Moderator's Report

Life and Health Sciences

Summer Series 2017

Foreward

This booklet outlines the performance of candidates in all aspects of CCEA's General Certificate of Education (GCE) in GCE Life and Health Sciences 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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Principal Moderator's Report

Across all three internally-assessed units the evidence produced by candidates was overall of a high standard.

However, to assist the moderation process centres are asked to be aware of the following general points:

- It is very important that the guidance issued to schools is followed when submitting work for moderation. Whilst the majority of centres did do this, it can cause problems if the guidance is not followed correctly. This guidance is available on the CCEA website and also the Life and Health Sciences microsite (GCSE and GCE A/AS Examinations Summer 2018 E-Moderation Product-Type Subjects Instructions to Teachers).
- Candidate Mark Records (available from Life and Health Sciences microsite) are provided for each internally assessed unit to assist teachers in allocating marks against Learning Outcomes/Assessment Objectives. Centres are requested to ensure that they are attached to the front of each portfolio when submitting to CCEA for moderation. It is essential when using the Candidate Mark Records that centres give a mark for each Learning Outcome (LO), corresponding to the Assessment Objective (AO). Failure to use the Candidate Mark Records correctly in the future will result in portfolios having to be returned to centres for re-marking.
- Clear annotation of candidate work is extremely helpful in the moderation process as it indicates to Moderators where credit has/has not been awarded by the centre. It is preferable if this could be completed using red pen and good practice in itself would suggest that centres should signpost/justify the award of credit for the purposes of internal moderation.
- With the exceptions of the AS 1 Report Proforma and Risk Assessments, candidates must independently choose layouts and make decisions about formatting when presenting assessment evidence. Providing candidates with work-sheets/writing-frames/results tables/etc constitutes help over-and-above that permitted under JCQ guidelines and will limit the awardable marks for the relevant LO to the lower end of Mark Band 1.
- Centres should avoid submitting work in bulky folders/covers and/or inserting work in plastic wallets. The preferred format is for evidence to be secured using treasury tags with the eCandidate Cover Sheet for Samples as the front cover, and the relevant Candidate Mark Record and Portfolio Record Proforma included.

The following Unit-specific comments have been provided by the relevant Assistant Principal Moderator, incorporating feed-back provided by the Moderators in their Team. These comments should be read as those of a "critical friend", and are intended to direct centres towards best-practice in the generation of candidate evidence.

Assessment Unit AS 1 Experimental Techniques

Across centres the majority of assessment decisions were appropriate and within tolerance; in some centres candidate evidence had been assessed using the original marking criteria and consequently some sections of the report, particularly Conclusions, were marked generously.

The majority of reports had been produced according to the suggested format, although not all candidates had written using the past impersonal tense. Some centres had used the CCEA Candidate Response Proforma to assist candidates to structure their evidence. The requirement for candidates to provide both a word-count and a bibliography for each report was not consistently observed across centres.

The following comments are intended to assist centres in the generation of assessment evidence in terms of both report content/structure and addressing individual LOs.

Introduction

Introductions varied greatly in detail: frequently there was no prediction/hypothesis stated nor any reference/link to the centre-defined Objective. Not all candidates included relevant scientific reasoning, or consideration of possible errors and limitations within the investigation.

Materials and Apparatus

Some candidates made excellent use of photographs to illustrate equipment used. Where photographs/diagrams have been obtained from the Internet the source must be referenced. Photographs/diagrams/drawings should be labelled, and attention should be paid to standard scientific conventions when drawing experimental apparatus.

Risk Assessment

Candidates displayed a tendency to concentrate on general laboratory rules, which is insufficient. At this level a Risk Assessment should include all materials and apparatus used, and should identify the hazard, the risk, and the control measures (including PPE) to be applied, with specific references to COSHH and CLEAPSS where appropriate. A numerically-based system of hazard identification is not required, but it is essential that all chemicals are identified specifically as used (including state and concentration as applicable), and where disposal of chemicals is an issue this should also be considered. Where electrical equipment is concerned, reference should be made to the state of the equipment/wiring and Portable Appliance Testing. 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.

Procedure

Procedures were generally described sufficiently well to enable them to be repeated. However, there was a tendency for centres to be lenient where a limited rather than detailed description was present. Centres are reminded that a proportion of the marks awardable are for the technical skill displayed by the candidates in working independently and safely when carrying out the investigation. Assessors should annotate candidate evidence to indicate separately how many marks have been awarded for the written procedure and how many for technical skill. A detailed written procedure on its own is not sufficient to attract full-marks.

Results

Candidates should pay attention to the number of decimal places to which results are recorded – this was often inappropriate and/or inconsistent. A significant number of candidates omitted units from graph axes. The use of Excel to produce graphs generally produced poorly-scaled graphs with insufficient coordinate lines to allow them to be read with any degree of accuracy.

Conclusion

A significant number of candidates scored within the lowest Mark Band for this section: many Conclusions were vague and gave little consideration to the evaluation of the method in terms of limitations, errors and improvements. Candidates displayed a great deal of confusion over the application/meaning of the terms accuracy, precision, and repeatability/ reliability.

LO 1.1.1 (Chemistry skills)

Some results tables were not constructed in the standard format commonly used. The criterion for concordant titres – two +/- 0.1 cm^3 – was not observed by all centres.

LO 1.1.2 (Chemistry skills)

It is not necessary for candidates to carry out both flame tests and tests for halide anions.

LO 1.1.3 (Chemistry skills)

Candidates should be encouraged to illustrate results graphically.

LO 1.2.2 (Physics skills)

Units for the resistivity equation were missing from many reports. Many reports showed no calculation of the cross-sectional area of the wire or its relationship to the equation for resistivity.

LO 1.2.3 (Physics skills)

The importance of using the lens equation to calculate the focal length was sometimes overlooked. Some graphs had not been constructed correctly for the experimental data.

LO 1.3.1 (Biology skills)

Within their Introduction many candidates did not include reference to the biochemistry underlying positive results for the various tests.

LO 1.3.3 (Biology skills)

Chromatograms (or copies) should be included within reports as evidence of the measurements taken – this was overlooked by a number of centres.

LO 1.3.4 (Biology skills)

An explanation of results in relation to the process of osmosis was often overlooked.

Chief Examiner's Report

Assessment Unit AS 2 Human Body Systems

This paper provided candidates with a range of abilities the opportunity to achieve marks in each of the seven questions provided. Candidate responses ranged from poor to excellent, with an overall majority of candidates attempting to answer all parts of every question on the paper. Most candidates attempted calculations, with varying degrees of success, while, with very few exceptions, candidates also achieved marks for quality of written communication.

Q1 **(a)** **(i)** Most candidates correctly identified structures A and B, however, a small number of candidates inverted the correct answers.

(iii) A significant number of candidates did not correctly identify the vena cava.

Q2 **(a)** **(i)** Most candidates correctly identified structures A and B, however, in many cases spelling was incorrect and not of the expected standard.

(iii) Alveolar adaptations were generally well known, however, in a significant number of cases the correct explanation was not provided for the adaptation given.

(b) The graph and the associated calculations were attempted by the vast majority of candidates and in general were done correctly.

Q3 **(a)** This question was answered well by most candidates. Marks were lost with respect to providing specific dietary advice for reducing fat intake, i.e. naming a specific high fat food source that should be restricted.

(b) Most candidates gave general advice to reduce alcohol consumption and did not provide the explicit information needed to achieve marks.

(c) Most candidates could not adequately explain why the woman was pale. In addition, while some students could link tiredness to low oxygen levels, most did not then go on to explain the link to energy production.

Q4 Candidates attempted this question to a reasonable-high standard, with marks for QWC being generally achieved. Most candidates identified weight gain, cardiovascular disease (heart attack/stroke) and diabetes as consequences of low levels of physical exercise. A smaller number of candidates also went on to identify reduced lung capacity and breathing problems such as asthma and COPD, as well as negative psychological effects, including depression and mental health issues. A very small number of candidates were able to link low levels of physical exercise to negative musculoskeletal issues including lack of strength and coordination.

Q5 **(a)** **(iii)** A significant number of candidates gave answers that were too general and did not mention blood glucose.

(iv) Most candidates provided one explanation, with the conversion of glucose to glycogen being the favoured answer, only a small number of students correctly identified the required second explanation.

(b) **(i)** Most candidates correctly identified that levels of blood glucose for untreated diabetes would be higher than those of a healthy person between 12 noon and 13.00, however, a significant number did not correctly identify that at 12 noon the dashed line should begin higher for the person with untreated diabetes.

(ii) A significant number of candidates provided answers identifying that, and how, glucose levels would differ but failed to explicitly state that insulin would be reduced or absent.

(b) **(iii)** Most candidates achieved marks for this question part, however, few gained all the marks available. Common mistakes included confusing energy release with glucose release. Very few candidates identified reduced blood glucose fluctuations or the reduced need for insulin, fewer identified the fact that the body uses glucose as it is released.

Q6 **(a)** **(i)** The majority of candidates did not correctly identify the main function of cholesterol in the human body.

(ii) Most candidates provided an answer that was too vague and not sufficiently specific to achieve a mark.

(c) Candidates of all abilities achieved marks in this question. Most candidates provided figures to substantiate that both the drink and drug reduced cholesterol levels, as well as identifying that the drug was more effective. More able candidates discussed the effects of the drink and drug with respect to healthy cholesterol levels and compared the time taken for each cholesterol-reducing treatment to achieve their effect.

Q7 **(a)** **(ii)** Most candidates were unable to provide a full description of the electron transport chain. Some candidates could identify energy release in terms of overall ATP release and/or levels of ATP from NAD and FAD.

Assessment Unit AS 3 Aspects of Physical Chemistry in Industrial Processes

This paper allowed candidates with a range of abilities to score in different parts of questions, with overall responses ranging from poor to excellent. It is pleasing to note that the vast majority of candidates attempted to answer all questions on the paper, with very few blank responses. In general, candidates were able to attempt chemical calculations and the quality of written communication questions but with varying degrees of success.

Q1 This question centred around the use of butane in portable home heaters or camping stoves. In Part (a) the definition of enthalpy of combustion was fairly well known. In Part (b)(i) candidates often listed a spirit burner as a required piece of apparatus misunderstanding that the camping stove was the source of fuel. Part (b)(ii) was on the whole well answered with candidates able to identify heat loss as the main source of error. The method for the bond energy calculation in Part (c)(i) was well known, however some candidates made minor errors when totaling values for the bonds broken and made during the process. Part (c)(ii) was not well understood, with many candidates simply stating that butane has more carbon atoms and missing the idea that there were more bonds to be broken and made during the combustion of butane. Part (d)(i) asked for the principle of conservation of energy, a number of candidates incorrectly stated Hess's law instead. Candidates found Part (d)(ii) and (iii) proved challenging and differentiated between candidates.

Q2 This question covered aspects related to the manufacture of sulfuric acid. In Part (a) the vast majority of candidates were unable to successfully write the balanced symbol equation required. In Part (b) many candidates did not fully answer the question, they either defined the term heterogeneous or catalyst when both definitions were required. The definition of activation energy in Part (c)(i) was well known. The Maxwell-Boltzmann curve in Part (c)(ii) was attempted by the vast majority of candidates however there was a varying degree of success. Some candidates drew an energy profile diagram which gained no credit, when the curve was drawn correctly the shape was generally good, but it is important that the curve begins at the origin and then does not touch the x-axis again. Part (c)(iii) was well answered on the whole with candidates having a good grasp of the concept of the effect of a catalyst on activation energy, some however did not answer in sufficient detail to gain all three marks. Part (c)(iv) was not well answered, whilst many candidates seemed to know the answer it was not expressed well, many candidates referred to the curve moving to the right as opposed to the correct answer that it is the peak of the curve that moves to the right.

Q3 There were varying degrees of success evident in this question about titrations. The definition of standard solution in Part (a)(i) was well known. In Part (a)(ii), whilst candidates were able to write a response to the question to outline the procedure for carrying out a titration, many were not able to describe the key steps. Many described the making of a standard solution, which gained no credit. A large number of candidates missed out the key steps of preparing the burette and pipette by rinsing with the solution that is to be used. Some candidates also missed out the idea of doing one rough titration and then two accurate titrations or at least repeating until the results are concordant. The standard of QWC on the whole was good. In Part (b)(i) candidates were able to state that phenolphthalein was used as there was a strong alkali involved in the titration, however in Part (b)(ii) many stated the colour change in reverse order. Part (c) and (d) involved calculations based on the titration results, most candidates scored well in Part (c) which involved working out the titre from the results and the mean titre. It is important to note that titres should be recorded to

two decimal places and when calculating the mean titre that the value for the rough titre is not used.

Q4 Candidates were asked to define the terms capital and direct costs in Part (a). However many candidates failed to give a suitable definition and instead gave examples of the types of costs. On the whole Part (b) was well answered on the environmental effects of constructing a chemical plant.

Q5 This question gave information on conditions for the Haber process. Part (a)(i) and (ii) were based on information from the graph, and were on the whole well answered, but some answered by simply quoting figures from the graph and not in terms of the trend. In Part (a)(iii) candidates were able to state the change on the position of equilibrium but failed to explain the reason for this change. Part (b)(i) was very successfully answered, Part (ii) and (iii) were more discriminatory. In Part (c) candidates found the balancing of the equation challenging and then were unable to answer Part (ii). In Part (iii) candidates were asked to explain catalytic poisoning, many candidates scored only one out of the three available marks because they did not answer in sufficient detail. A large number of candidates described the reactants absorbing on the catalyst as opposed to adsorbing on the surface.

Principal Moderator's Report

Assessment Unit AS 4 Brain Science

Candidate evidence was presented in a range of formats: posters, leaflets, PowerPoint presentations, reports, and investigations. 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.

Some centres had failed to identify that the minimum required tasks detailed under submission requirements do not generate evidence to cover all LOs detailed within the specification, and that further centre-devised tasks – which are indicated on the Candidate Mark Record – are also required: where this had occurred advice to the centre was provided by the Moderator through the TAC6.

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

The healthy and damaged brain

Most candidates were able to access Mark Bands 3 and 4. Candidates clearly described the parts of the brain and the behavioural and cognitive effects caused by damage to the frontal lobe. Some candidates outlined the effects of damage to all areas of the brain, but this is not required in the specification. Research into mental health awareness statistics, strategies, and initiatives in NI was generally based on up to date sources, and identified the main trends/patterns. Some centres had failed to produce a centre-devised task investigating the effects of adrenaline.

The physiological and psychological effects of stress

The majority of candidates had produced questionnaires to investigate the effects of stress in teenagers at two key stages. Candidates had collected and processed data soundly, however, the majority of candidates found it difficult to draw conclusions from their findings.

Cognitive science

The investigations carried out by the majority of centres looked at the role of chunking in short-term memory using a computer-based application. This was an appropriate investigation which allowed candidates to collect and process data – many centres did not use the opportunity to apply standard deviation and confidence limits to provide an opportunity for statistical analysis of the data to allow candidates to access the top of Mark Band 4. A common weakness was the inability of candidates to relate the findings of the investigation(s) conducted to the LOs covered by AO1. In some cases evidence towards these LOs was absent from candidate portfolios.

Psychopathology and treatment

The majority of candidates used a range of sources to gather information on phobias, depression and OCD. However, some candidates presented little assessment evidence for this part of the specification.

Research methods

Many of the LOs in this section can be addressed through the investigations into stress and memory elsewhere within the Unit. However, the majority of centres generated evidence for this separately through stand-alone activities.

Chief Examiner's Report

Assessment Unit AS 5 Material Science

Q1 **(i)** Most appreciated that the indenter used in a VH Tester is generally made of diamond.

(ii) Many were unaware that the indenter shape is a square based pyramid. Very few knew that the angle between the faces is 136°.

(iii) Only a minority of candidates knew the time of application was around 10-15 seconds.

(iv) Although the units Pascal or VH or DPH were anticipated, only the better candidates seemed to be familiar with them.

Q2 **(i)** Most candidates were aware of the equation for stress in terms of force and area. However, some attempted to find the stress using the equation for the Young Modulus. Others appreciated that they had to find the cross-section area, but they were unable to use the formula for the area of a circle. Many did not first convert the diameter from millimetres to metres and had difficulty finding the area in m^2.

(ii) The calculation of strain was generally well done, but some failed to realise that the extension and the original length must be in the same units if the correct ratio is to be found.

(iii) This calculation was straightforward although 10n errors were often seen. Such errors forfeited one mark.

(iv) Many candidates were unable to distinguish between the limit of proportionality, the elastic limit and the yield point.

Q3 **(i)** This part of the question was quite well done by most candidates. However, although many could find the mass of the 500 cm^3 of salt water, few remembered to subtract the mass of the water itself to find the mass of the salt.

(ii) This was a challenging question for almost all candidates. The easy way to solve the problem was to observe that the new solution could have only 40 grams of dissolved salt in every 1000 cm^3 of solution. The existing solution had 40 grams of salt in 500 cm^3 of solution, so an additional 500 cm^3 of water had to be added.

(iii) This graph required candidates to realise that, as additional water was added, the density of the solution would fall from 1.08 g cm^{-3}, but never fall below 1.00 g cm^{-3}. The decrease is non-linear and asymptotic to the horizontal at 1.00 g cm^{-3}. While some achieved one mark for the decreasing density, few obtained the second mark.

Q4 **(a)** **(i)** Most realised that graphene and graphite are different forms of carbon.

(ii) Most realised that the atoms in graphite are arranged in hexagons.

However, candidates were also required to show that these sheets of carbon atoms are arranged so that one layer can move over another. This was not always shown.

(b) **(i)** The essential idea being assessed was that a nanotube is a graphene sheet rolled into a cylinder. This was known by only a minority of candidates.

(ii) Almost all candidates scored at least one of the two available marks and many obtained both marks.

Q5 This question on annealing was well done. The most common errors related to the inaccurate definition of an alloy and the cooling process when annealing. There was some confusion between annealing and quenching.

Q6 This question explored the differences between bioinert and bioactive materials. Unfortunately, the differences were not well understood by the majority of the candidature. They did better in Part (d) where knowledge of the use and benefits of titanium in jaw-bone surgery was frequently seen.

Q7 **(a)** This was generally done well by candidates.

(b) **(i)** Most candidates knew the (2,8,4) structure of silicon.

(ii) Most knew that silicon has (almost) no delocalised electrons at room temperature.

(iii) A minority of candidates did not recognise the majority carriers in n-type and p-type silicon.

(iv) Few knew that a Group 5 element is added to dope silicon to become n-type.

(c) **(i)** The circuit diagram was poorly done. Few knew the symbol for a diode.

(d) **(ii)** Very few knew about the operation of a junction diode in reverse bias.

Q8 Parts (a) and (b) of this question were on polymers. Part (c) was on smart materials.

(a) **(i)** It was disappointing that a large number of candidates could not give a satisfactory definition of a polymer.

(ii) It was good to see that so many candidates knew the differences between thermosets and thermoplastics in terms of their molecular structure and their response to heat.

(b) **(i)** Many were able to quote the properties of unplasticised PVC which make it suitable for use as sewage pipes.

(ii) However, fewer candidates could state common uses for plasticised PVC.

(c) **(i)** In giving applications of QTCs many candidates lost marks needlessly by writing vague answers. For example, quoting a “mobile phone” is much less satisfactory than “the touch screen on a mobile phone”.

(ii) This was well answered.

(iii) Only the better candidates recognised the use of smart memory alloys in the nitinol spectacle frames.

Principal Moderator's Report

Assessment Unit AS 6 Medicine, Drugs and Clinical Trials

In general, the work produced by candidates was of a very high standard and had been assessed appropriately by centres, although there was evidence that centres were marking leniently for those LOs within AO3. The award of higher marks should be reserved for those candidates who produce work that is evaluative and comprehensive.

Categories of medicine

Candidates addressed this part of the specification competently. The classification of medicines was detailed with several classifications discussed, but centres must ensure that candidates provide relevant examples for each category; all relevant methods of developing new drugs were included, however, some centres allocated maximum marks to candidates who had provided very little evidence/detail for each method.

Medicines from concept to consumer

LO 6.2.1 requires candidates to choose one medicine and use this as the basis for generating evidence towards the LOs in both content 6.2 and 6.3 Some candidates selected two medicines – this does not generate additional assessment evidence since evidence from only one medicine can be considered for award of credit. It is not acceptable to target different LOs through consideration of alternative medicines. LOs 6.2.4, 6.2.5, and 6.2.11 showed variation in delivery/content across centres, with candidate evidence justifying award of marks within Mark Band 4. Evidence for LO 6.2.7 sometimes did not justify higher marks, where awarded. The role of the manufacturing sector in the development of medicines was not considered in sufficient detail – this is an area where centres would benefit from engaging with manufacturers within the pharmaceutical sector, but there is also scope for centres/candidates to look beyond the UK and to consider this issue on a global scale. For LO 6.2.8 candidates should consider the roles of a minimum of two UK [sic] regulatory bodies; this must be in detail to allow access to Mark Band 4. For LO 6.2.11 several candidates did not consider pharmacokinetics/pharmacodynamics/dosage/administration/metabolism in relation to their chosen medicine; these areas can be discussed in general, but there must also be some consideration specific to the medicine selected in LO 6.2.1.

Actions of medicines within the body relating to their functionality

All areas within LOs 6.3.1 and 6.3.2 must be evidenced, but this need only be in the context of the medicine selected in 6.1.1 Centres had devoted too much time to generation of evidence around a wider consideration of this area – rather than focussing, in depth – on the one selected medicine.

Analysis of medicines through quantitative analysis and bioassays

The majority of experiments chosen for this section were valid and appropriate, allowing candidates to access all AOs/LOs. Detailed scientific principles were discussed in most cases relative to the chosen procedures. However, centres are reminded that for LO 6.4.2, for each of the two practical procedures chosen, research on possible alternative methods must be evidenced, with a justification as to why the chosen method was selected. It is not acceptable to simply include "cut-and-paste" information on alternative methods. Evidence for LO 6.4.8 should be provided by some commentary/evaluation provided by the teacher/assessor. The standard of risk assessment required for LO 6.4.8 is detailed in the commentary on "Risk Assessment", within Unit AS1 – to which centres are referred. For LO 6.4.10 many portfolios had been marked too leniently, especially within the higher Mark

Bands. To access marks within Mark Bands 3 and 4 candidates should be providing detailed conclusions, linked to scientific principles, as well as an evaluative approach to technique, methodology and potential improvements.

Contact details

The following information provides contact details for key staff members:

- **Specification Support Officer: Nola Fitzsimons**
  (telephone: (028) 9026 1200, extension: 2235, email: nfitzsimons@ccea.org.uk)
- **Officer with Subject Responsibility: Paul Wright**
  (telephone: (028) 9026 1200, extension: 2207, email: pwright@ccea.org.uk)

COUNCIL FOR THE **CURRICULUM, EXAMINATIONS** AND **ASSESSMENT**
29 Clarendon Road, Clarendon Dock, Belfast BT1 3BG
Tel: +44 (0)28 9026 1200 Fax: +44 (0)28 9026 1234
Email: info@ccea.org.uk Web: www.ccea.org.uk

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