Rewarding Learning

CCEA GCSE Science (Double Award Unitised) (Legacy)
March Series 2018

Chief Examiner's Report

science

double award - unitised

Foreword

This booklet outlines the performance of candidates in all aspects of CCEA's General Certificate of Secondary Education (GCSE) in Double Award Science 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.

Contents

GCSE SCIENCE: DOUBLE AWARD

Chief Examiner Report

Paper 1 Biology

Assessment Unit 1 Cells, Living Processes and Biodiversity

Introduction

These papers were accessible to all the candidates. There was a full range of marks awarded on both papers. However it was clear that candidates were not all familiar with some of the new content on the Unit 1 Specification. This was centre specific. In addition there was evidence of some candidates being entered for the higher tier when the foundation tier was more appropriate tier for their ability.

Foundation Tier

Q1 **(a) & (b)** Most candidates answered both Parts (a) and (b) well.

(c) Surprisingly a few candidates did not choose the correct word for Part (c).

(d) In Part (d) it was clear that a few centres had not covered this material on the excretory system and therefore could not identify the kidney and the bladder.

Q2 **(a) & (b)** The majority of candidates completed the equation for photosynthesis and answered Part (b) correctly.

(c) These question parts were either well answered, or, candidates were unfamiliar with the topic of leaf structure and struggled to answer the questions.

Q3 Only a few candidates mixed up the positions of the pond skaters and pond snails when completing the food web in Part (a). The other parts of the question were generally well answered.

Q4 Most candidates correctly linked the food substances and reagents in Part (a). However some candidates mixed up the colour changes of the reducing sugar and the protein in Part (b). Many candidates correctly answered Part (c).

Q5 Part (a) was well answered but the answers to Part (b) were confused. Diabetes Type 1 and Type 2 are a new detail on this specification and candidates should stick to the changes in insulin production specified to ensure they gain these marks. Part (c) was accessible to all candidates.

Q6 Most candidates were awarded some marks on this QWC question but few gave sufficient points to be awarded the highest band marks. Some incorrectly gave adaptations of red blood cells or adaptations of the lungs as a whole rather than the adaptations of the respiratory surface.

Q7 Quite a few candidates were not clear about abiotic and biotic factors and therefore answered Parts (a)(i) and (b) incorrectly. In Part (c) most candidates were able to correctly extract information from the table to answer the question.

Q8 **(a)** **(i)** Many candidates were able to at least gain one mark here.

(ii) Hardly any candidates could correctly work out the percentage increase. If they showed their working out at least they were able to gain partial credit for the question. Candidates should be encouraged to show their working out for this reason.

(b) & (c) These parts of the question were difficult but candidates were able to answer some parts of these questions especially the last part where they were able to explain about enzyme specificity.

Higher Tier

Q1 Part (a) was well answered but some failed to put the steps in the correct order in Part (b). Diabetes Type 1 and Type 2 are a new detail on this specification and candidates should stick to the changes in insulin production specified to ensure they gain these marks. Part (c) was accessible to all candidates.

Q2 The responses were better than on the foundation tier on this QWC question with more candidates giving sufficient points to be awarded the highest band marks. Some incorrectly gave adaptations of red blood cells or adaptations of the lungs as a whole rather than the adaptations of the respiratory surface.

Q3 A few candidates were not clear about abiotic and biotic factors and therefore answered Parts (a)(i) and (b) incorrectly. In Part (c), most candidates were able to correctly extract information from the table to answer the question.

Q4 **(a)** **(i)** Many candidates were able to at least gain one mark here.

(ii) Very few candidates could correctly work out the percentage increase. If they showed their working out at least they were able to gain partial credit for the question. Candidates should be encouraged to show their working out for this reason.

(b) & (c) These parts of the question were difficult but many candidates were able to correctly answer some parts of these questions especially the last question where they were able to explain about enzyme specificity.

Q5 Parts (a), (b) and (c) were correctly answered by most candidates although some candidates did not read Part (c) correctly. In Part (d), many candidates gave the correct explanations. In Part (e), several candidates failed to recognise that if the yeast was dead there would be no reaction and the limewater would not change.

Q6 Parts (a) and (b) were well answered by most candidates. In Part (c), when the topic of eutrophication is asked as a whole process, for example, in a QWC question, then candidates generally can cope well with the question but when they are asked specific questions about the different stages in the process they have more difficulty.

Q7 It was clear that candidates from some centres had not covered this topic on the kidney and excretion. The candidates that were familiar with the topic coped well with the question. In Part (b)(ii) many candidates did not give data to support their answer as instructed and therefore lost a mark.

Q8 The nitrogen cycle is a difficult topic but a large number of candidates coped well with the questions in Part (a). Many candidates made the link with active transport in Part (b)(i) but had more difficulty with the explanation for Part (b)(ii).

Q9 Many candidates gave good explanations here but candidates should mention both the processes of photosynthesis and respiration and their relative rates in questions on this topic.

Paper 1 Chemistry

Assessment Unit 2 Structures, Trends, Chemical Reactions, Quantitative Chemistry and Analysis

Foundation Tier

This was the first sitting of the new DAS Unit C1 exam. A wide range of marks with few very low marks was evident. There was little, if any, evidence of Foundation Tier candidates being entered at the wrong tier. The paper was successful in providing candidates of differing abilities the opportunity to respond positively. Some candidates provided excellent responses throughout the paper. There was evidence of variability in responses from centre to centre, particularly in respect of new topics or types of question which were being examined for the first time in this paper. This specification has many new areas that need to be examined and each exam paper needs to cover some of these. Additionally the Foundation Tier paper now has 60 marks, compared with 70 marks in the legacy specification.

Q1 The first question was about atomic structure. Nearly every candidate got off to a very good start, gaining the full 3 marks by identifying the protons, neutrons and electrons from a diagram of an atom of an unnamed element (X). Part (b) proved more difficult for some and was more discriminatory. In Part (b)(i), candidates were asked for the atomic number of X. Some did not equate this to the number of protons shown in the diagram. Similarly, Part (b)(ii) asked for the mass number and some candidates did not understand that they needed to add the number of protons and neutrons to find this. In the final part a small number of candidates knew that an atom has no electrical charge because the number of protons equals the number of electrons.

Q2 The first part of this question was about hazard symbols and was really well answered. A high proportion of candidates gained all 5 marks. In Part (b)(i), candidates needed to know the results of the chemical test for chlorine. This is a new topic area for the specification. Many candidates were familiar with the test but some were not. Many were able to give a physical property of chlorine which enables it to be identified. Where a colour is given, green is needed e.g. green or yellow-green are both correct but yellow is not. Nearly everyone knew, in Part (b)(iii), that chlorine is a Group 7 element.

Q3 This question was generally not well answered. Of the 10 marks available, it was rare to see more than 6 or 7 marks being gained and common to see 2 or 3 marks. Parts (a) and (b) were about pure substances; the topic is new to the specification but clearly set out. Many candidates did not know how to test if a substance is pure or what is meant by the term “pure substance”. In Part (c)(i), candidates were given a diagram showing a simple distillation process and asked why the thermometer is placed at the neck of the flask. Very few understood that that positioning means that it measures the temperature of the vapour. The remaining 5 marks in Part (c) were of the cloze question type and produced better responses. Although nearly everyone scored at least 3 out of 5, many candidates made one or more errors. Finally, in Part (d), the need for a fractionating column was a mystery for virtually everyone. Fractional distillation is another new topic on this specification.

Q4 This question was about acids, bases and salts. It proved to be a good discriminator. Part (a) asked candidates to identify a weak acid, a strong alkali and a salt from a list of six substances. It was rare to come across a script with all three correct responses and quite common to see "strong alkalis" which were not even alkalis or even weak acids which did not have the word "acid" in their name.

In Part (b), many candidates seemed to have to guess the pH of a solution containing a named weak acid because a range of wrong answers was seen and, in Part (b) (ii), only a minority knew the pH range for a strong alkali solution. In Part (c) some better candidates could complete the word equation for the given acid-base reaction. This involved nitric acid, whose use is new to this specification. Most knew that the reaction was a neutralisation.

Q5 This was a calculation question. Previously, mole calculations had been examined in the C2 module. Now they are on the C1 module along with new topics such as percentage of an element by mass. The appearance of these topics, alongside a requirement for 20% mathematical content across the DAS examination papers as a whole, means that candidates and teachers should expect calculations of some type in every C1 paper.

Some parts of this question were very well answered by a high proportion of candidates, which is very pleasing. For the topic areas which are new to the DAS specification there was a more variable, often centre specific, quality of response.

Parts (a) and (b)(i) were generally well answered. Many could work out both the relative formula masses and some could calculate the mass of 0.60 moles of ammonium nitrate. In Part b(ii), very few foundation tier candidates knew a correct method to work out the percentage of nitrogen by mass.

Q6 The first part of this question was about the electronic arrangements in a sodium atom and an oxygen atom and also in their respective ions. Virtually everyone gained both marks in Part (a)(i) by completing the diagrams for the atoms. In Part (a)(ii), few correctly wrote 2,8 and 2,8; many misread the question and gave the electronic configurations of the atoms again. Flame tests have been added to the specification. Some, but not a majority, picked out the flame colour of a sodium ion from five options. In Part (b)(i), dot and cross diagrams for HCl were usually excellent and many knew that there are three lone pairs of electrons, enabling them to gain all 4 marks for this part of the question.

Q7 The first part of this question was a structured QWC question and was essentially about graphite and diamond. Most candidates recognised these two allotropes from the structural diagrams but few foundation tier candidates knew the definition of an allotrope. In the second and third sections of this part, it was essential to link any statements about the structure to the property or use; for example allotrope B has strong covalent bonds but this statement, on its own, does not explain why it has a high melting point or why it is hard. Most foundation tier candidates gave 2-4 of the indicative points and the vast majority of these were awarded 2 marks. Better candidates gave 5-7 or more indicative points and this, combined with the quality of their communication, gained them 4 marks. Only a very small number, at this tier, gave more than 7 indicative points and so very few gained the full 6 marks.

Part (b) of the question covered another new topic area, graphene. Some knew that graphene is essentially a single layer of graphite and gained both marks. The idea of a single layer was essential for any credit. Most worked out or knew in Part (b)(ii) that graphene conducts electricity. Part (c) was challenging and very few gained the mark. Many knew that graphene has very strong covalent bonds but this fact alone does not explain graphene's strength. Essentially all covalent compounds have strong bonds but few can be described as very strong. Graphene's strength comes from the fact that its strong covalent bonds are in a single layer.

Higher Tier

This was the first sitting of the new DAS Unit C1 exam. A wide range of marks with few very low marks was evident. There was little, if any, evidence of Higher Tier candidates being entered at the wrong tier. The paper was successful in providing candidates of differing abilities the opportunity to respond positively. Some candidates provided excellent responses throughout the paper. There was evidence of variability in responses from centre to centre, particularly in respect of new topics or types of question which were being examined for the first time in this exam paper. This new specification has many new areas that need to be examined and each paper needs to cover some of these.

Q1 The first part of this question required candidates to complete a table about atomic structure. Very few candidates gained all 5 marks but most gained 3 or 4 marks. Whilst the 3 marks available for information about atoms were commonly gained, two of the particles were ions and this caused problems particularly working out the number of electrons in an ion which had 12 protons. In Part (b) the majority knew what was meant by the term "isotope".

Q2 Part (a) of this question focussed on ionic bonding between two atoms whose electronic configurations were given. It was a good discriminator. Many worked out that an atom of Q would transfer 1 electron and that an atom of R needed to gain 2 electrons. However, very few could use this information to write the correct formula, Q_2R, for the compound. Apart from seeing wrong formulae, it was very common to see equations given as the answer. Teachers and candidates need to be aware that if a question asks for a "formula" and an equation is given as the answer, it will be marked wrong, even if the equation contains a correct formula. Part of the skill required is to recognise the difference between a formula and an equation.

In Part (b), nearly everyone knew what an anion is but in Part (b)(ii), hardly any candidates could give a half equation for the formation of a chloride ion from a chlorine atom.

Q3 This question was also a good discriminator. It tested different skills including the ability to evaluate information provided and also to use mathematical skills. Nearly every candidate handled the mathematical aspects in Part (a) very well.

Part (b) required evaluation of the relative merits of 18 and 9 carat gold in making jewellery. This was well answered. Nearly everyone gained 2, if not all 3 marks. Part (c) tested understanding of the term "formulation" which has been added to the specification. It was very poorly answered. Candidates from a small number of centres were able to access all 3 marks because they knew 3 of the four key marking points, namely that formulations are alloys/mixtures of metals in this case, that they are designed as useful products, that they have carefully measured proportions and that the product has required/desirable properties. Many candidates seemed to be very unfamiliar with the term formulation.

Q4 The first part of this question was a structured QWC question and was essentially about graphite and diamond. Practically everyone recognised these two allotropes from the structural diagrams and better candidates knew the definition of an allotrope. In the second and third sections of this part, it was essential to link any statements about the structure to the property or use; for example allotrope B has strong covalent bonds but this statement, on its own, does not explain why it has a high melting point or why it is hard. Many higher tier candidates gave 5-7 of the indicative points and the vast majority of these were awarded 4 marks. Top candidates gave 8 or more indicative points and this, combined with the quality of their communication, gained them 6 marks.

Part (b) of the question covered another new topic area, graphene. Many knew that graphene is essentially a single layer of graphite and gained both marks. The idea of a single layer was essential for any credit. Most worked out or knew in Part (b)(ii) that graphene conducts electricity. Part (c) was challenging and very few gained the mark. Most knew that graphene has very strong covalent bonds but this fact alone does not explain graphene's strength. Essentially all covalent compounds have strong bonds but few can be described as very strong. Graphene's strength comes from the fact that its strong covalent bonds are in a single layer.

Q5 The first part of this question was about the electronic arrangements in a sodium atom and an oxygen atom and also in their respective ions. Virtually everyone gained both marks in Part (a)(i) by completing the diagrams for the atoms. In Part (a)(ii), whilst many correctly wrote 2,8 and 2,8, some misread the question and gave the electronic configurations of the atoms again. Flame tests have been added to the specification. Some, but not a majority picked out the flame colour of a sodium ion from five options. In Part (b)(i), dot and cross diagrams for H_2O were usually excellent and most knew that there are two lone pairs of electrons, thus gaining all 4 marks for this part of the question.

Q6 This was a calculation question. Previously, mole calculations had been examined in the C2 module. Now they are on the C1 module along with new topics such as percentage yield and percentage of an element by mass. The appearance of these topics, alongside a requirement for 20% mathematical content across the DAS examination papers as a whole, means that candidates and teachers should expect calculations of some type in every C1 paper.

Some parts of this question were very well answered by a high proportion of candidates, which is very pleasing. For the topic areas which are new to the DAS specification there was a more variable, often centre specific, quality of response.

Parts (a) and (b)(i) were well answered. Nearly everyone could work out both the relative formula masses and calculate the mass of 0.60 moles of ammonium nitrate. In Part b(ii), some knew a correct method to work out the percentage of nitrogen by mass but the vast majority did not. Of these, quite a number used the working out space to calculate the relative formula mass of ammonium nitrate, even though this had been given in the question.

Part (c)(i) asked candidates to work out the mass of one substance needed to make a given mass of another. The essential first steps in this calculation are to work out the number of moles in the given amount of substance (5 moles in this calculation) and to use the given equation to work out the ratio between the number of moles to the two substances (2:1 in this calculation). A few candidates calculated the "5 moles" bit but even fewer knew what to do with this number because they did not find or use the 2:1 ratio. This meant that very few candidates gained all 3 marks for the correct answer, although some did gain 1 method mark.

The remainder of the question was about percentage yield. For those who had practised these calculations it was very straightforward but most candidates did not know how to work out the answer.

Q7 This question was centred on reactions of acids and produced variable responses. In Part (a), there were 5 marks available for the completion and balancing of two formula equations. Many candidates gained no marks, some gained 1, usually for recognising the formation of H_2O in the second equation, but it was very rare to see candidates gaining any marks for the first equation. The products, a salt and hydrogen, were given but it proved to be too difficult for candidates to work out that a metal (Mg) and an acid (H_2SO_4) were needed.

Part (b), the test for carbon dioxide, was well known. In Part (c), many knew that alkalis produce the hydroxide ion in water but there was no credit for giving a formula. In Part (d), many better candidates are now able to write accurate ionic equations for neutralisation. Some knew that a weak acid is only partially ionised but fewer added "in water".

Q8 Quite often there has been a question towards the end of the higher tier paper which focusses on displacement reactions of halogens. Even though these questions show many similarities, the standard of answering in the legacy specification papers had invariably been very poor. This was, once again the case for this question. In Part (a), most recognised that a displacement reaction was involved and gained a mark. For many, this was the only mark, out of 7 marks available, which they gained.

In Part (b), it was rare to see well constructed answers which recognised that iodine is less reactive than chlorine and cannot displace it. In Part (c), the biggest problem in writing a balanced symbol equation for a halogen displacement reaction, is often the ability to write the correct formula for a halogen and the ability to write the correct formula for a Group 1 halide. It also remains so common to see formulae applied inconsistently; e.g. the halogen as diatomic on one side of the equation but the other halogen as monatomic and/or XY_2 as the formula for one or both halide salts.

In the final part of the question, it was necessary to state that halogens need to gain one electron to become stable for credit.

Paper 1 Physics

Assessment Unit 3 Motion, Force, Moments, Energy, Density, Kinetic Theory, Radioactivity, Nuclear Fission and Fusion

Foundation Tier

The new Specification contains some new topics and the examiners included a number of these in the March papers. It was noticeable, however, that coverage of the new material varied from centre to centre with some centres not addressing the new material at all or covering it inadequately.

It was pleasing to see, however, that most students were able to perform very satisfactorily in the 'traditional content' questions.

Q1 This opening question on the Foundation Tier had a very familiar look about it and candidates fared well.

Q2 **(a)** Part (a) was well answered.

(b) In Part (b) the new equation, average speed = (initial speed + final speed/2) was examined but was not particularly well answered – perhaps because average speed = total distance/total time was on the old specification and students tried to use this equation instead. It was still possible to use this second equation if distance travelled was obtained from the area under graph.

Q3 **(a)** The response to Part 3 (a) was mixed with only some realising that the object would move with a constant speed in a straight line. Some candidates stated 'there is no gravity in space'.

(b) Part (b) was well answered.

Q4 **(a)** New specification material - Part (a) was well answered.

(b) Part (b) was a straightforward pressure calculation and most got the correct equation but many failed to get the correct final answer because they did not take into account the fact that the lizard was standing on two feet.

Q5 **(a)** Part (a) was well answered.

(b) In Part (b) most candidates scored 2 out of 3.

(c) Part (c) was also well answered although some students were careless and simply wrote solid, liquid, gas instead of the opposite.

Q6 Almost every Foundation Paper contains a mass-weight conversion problem which simply involves a factor of 10. Yet there remain far too many instances where there is division instead of multiplication or vice-versa. With ecf candidates were able to score well in Part (b).

Q7 **(a)** Part (a) was well answered.

(b) Part (b) – students are now more aware that nuclei disintegrate because they are unstable.

(c) Part (c) was well answered.

Q8 **(a)** This question examined new material (Hooke's law) in the form of a QWC question. Most students got 4 of the 6 marks available. The question informed students that masses in kg were supplied and they were asked how to calculate the force. Many stated the equation F = ke rather than simply stating 'multiply the mass by 10'. In the 'Finding the extension' part students were penalised for vague statements like 'measure the spring' rather than 'measure the length of the spring'.

(b) In Part (b) most were able to find the extension but some forgot to add the original length to get the total length.

Q9 This proved to be the most discriminating question on the paper. In Principle of Moments questions students know the correct equation but have difficulty in getting the correct 'distance to pivot' when they apply the equation.

Higher Tier

The Examiners included some of the new topics in this paper. As in the Foundation paper the responses varied from centre to centre. It was noticeable that some centres had either not addressed the new material or had covered it inadequately.

Questions 1 to 4 were common to both papers and generally higher candidates performed very well in Questions 1 to 3. Question 4 however caused some difficulty. Students know the Principle of Moments equation well but have difficulty applying it. Performance on this type of question would be greatly improved if students took care with the following: Part (i) weight acts through the centre of gravity; Part (ii) the distances used in the equation must be distances to the pivot.

Q5 Pressure question – a new topic which was quite well answered. Some, though, forgot to subtract the weight of the container.

Q6 In Part (b) some had difficulty in converting mW to W and the one minute time interval to seconds. Both were necessary to get full marks.

Q7 **(a)** Ionisation is now better known.

(b) In Part (b) well prepared students picked up full marks. A common error, however, was to give 41 for the Tc atomic number instead of 43.

(c) Part (c) was also well answered.

Q8 **(a)** Part (a) proved to be quite challenging with few picking up all marks.

Q9 In Part (a) it was common to see the equation, a = (v-u)/t quoted (and sometimes average velocity = (v-u)/t) rather than average velocity = (Initial vel. + final vel.)/2 In Part (c) candidates were expected to find the acceleration from the velocity – time graph and then apply F=ma. It was good to see that a number of candidates were able to do so.

Contact details

The following information provides contact details for key staff members:

- **Specification Support Officer: Nuala Tierney**
  (telephone: (028) 9026 1200, extension: 2292, email: ntierney@ccea.org.uk)
- **Officer with Subject Responsibility: Elaine Lennox**
  (telephone: (028) 9026 1200, extension: 2320, email: elennox@ccea.org.uk)