GCSE

Rewarding Learning

## Chief Examiner's Report

# Double Award Science

November Series 2020

# Foreword

This booklet outlines the performance of candidates in all aspects of this specification for the November 2020 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 section on our website at www.ccea.org.uk.

# Contents


| | | |
|---|---|---|
| **Assessment Unit 1** | Biology: Living Processes and Biodiversity | 3 |
| **Assessment Unit 2** | Chemistry: Structures, Trends, Chemical Reactions, Quantitative Chemistry and Analysis | 7 |
| **Assessment Unit 3** | Physics: Motion, Force, Moments, Energy, Density, Kinetic Theory, Radioactivity, Nuclear Fission and Fusion | 12 |
| **Contact details** | | 14 |

# GCSE DOUBLE AWARD SCIENCE

# Chief Examiner's Report

# Paper 1 Biology

# Assessment Unit 1 Living Processes and Biodiversity

## Foundation Tier

All questions were accessible to candidates and the majority of candidates on both tiers were well prepared for the exam.

Many candidates answered the question on the control of blood glucose very well but others found this question difficult. Some candidates find calculations involving percentages challenging. Candidates should be reminded of the advantage of showing their working out in calculations since this often means they gain a proportion of the marks for the question.

In the QWC question most candidates could name and describe some of the steps in the formation of fossil fuels, or how the carbon in fossil fuels is returned to the atmosphere in the carbon cycle and therefore were awarded at least two marks. Candidates should be encouraged to structure their answer in sentences in a QWC question.

**Q1** **(a)** Many candidates correctly linked the structures and functions of plant and animal cells. However, there were some candidates that mixed up the chromosome and nucleus functions.

**(b)** Most candidates obtained at least two marks for this question but many did not correctly complete the last box.

**Q2** **(a)** The majority of candidates correctly identified protein for the type of biological molecule linked with meat and then correctly gave the function of proteins. Other parts of the table were not completed well by many candidates.

**(b)** Surprisingly quite a few candidates could not explain why enzymes are needed to break down large insoluble molecules.

**Q3** **(a)** **(i)** Many candidates found this question difficult. Some wrote the answers for the two boxes in the wrong order and some wrote brain and spinal cord for this part of the question as well as in (ii).

**(ii)** Quite a few candidates correctly answered brain and spinal cord.

**(b)** **(i)** Most candidates correctly calculated the average distance travelled by the ruler.

**(ii)** The majority of candidates found this question difficult with many incorrectly comparing the results from student A with the results from student B.

**Q4** **(a)** Most candidates correctly completed the organisms in the food web but quite a few did not go on to add the arrows to show the direction of energy flow in the food web.

**(b)** Only a small minority of candidates incorrectly gave the primary producer rather than the primary consumer.

**(c)** The majority of candidates gave correct answers for this question.

**Q5** **(a)** Most candidates correctly completed at least one or two of the blanks about hormones.

**(b)** As stated in the general unit comments, some candidates found this question about control of blood glucose concentration difficult but there were also some excellent answers.

**Q6** **(a)** Most candidates found this percentage calculation difficult but those that showed their working out often included correct stages and so were awarded a proportion of the four available marks.

**(b)** This question was well answered by most candidates but all the possible incorrect answers from the list were seen by examiners.

**Q7** **(a)** Many candidates gave the three correct answers for the equation for photosynthesis.

**(b)** There were many correct answers here.

**(c)** Only the more able candidates were able to identify respiration as the process.

**(d)** Quite a few candidates gave a correct answer for the meaning of the term endothermic.

**(e)** **(i)** Many candidates correctly answered this question but some incorrectly read of the y-axis and gave the rate of photosynthesis rather than the light intensity figure.

**(ii)** Most candidates were awarded some marks for their graph.

**(f)** A large number of candidates incorrectly think that any temperature increase results in the denaturation of enzymes.

**Q8** As stated in the overview, in the QWC question most candidates could name and describe some of the steps in the formation of fossil fuels, or how the carbon in fossil fuels is returned to the atmosphere in the carbon cycle and therefore were awarded at least two marks. Others were able to give more complete answers.

## Higher Tier

There was a very wide range of marks awarded on this paper.

Candidates found (7)(c), (d) and (e) on respiration and (8)(b) on the nitrogen cycle challenging. Some candidates performed very well on Question (9) obtaining all the available marks for this question on photosynthesis and respiration. There was a full range of marks for this question with some candidates having difficulty in understanding the processes and concepts despite the fact that they had alternatives that they could choose from, for five of the available marks.

**Q1** **(a)** Most candidates correctly completed the organisms in the food web but some did not go on to add the arrows to show the direction of energy flow in the food web.

**(b)** Most candidates gave the correct answer here.

**(c)** The majority of candidates gave correct answers for this question.

**Q2** Most candidates obtained the majority of the marks available for the question.

**Q3** **(a)** Some candidates found this percentage calculation difficult but those that showed their working out often included correct stages and so were awarded a proportion of the four available marks.

**(b)** This question was well answered by most candidates but all the possible incorrect answers from the list were seen by examiners.

**Q4** **(a)** This part of question 4 was not common with foundation question on photosynthesis.

Most candidates gave the correct formula for glucose.

**(b)** This part of question 4 was not common with foundation question on photosynthesis.

Many candidates correctly identified the correct storage carbohydrate as starch but glycogen and cellulose were also quite common incorrect answers.

**(c)** More candidates than on the foundation paper gave a correct meaning for the term endothermic.

**(d)** **(i)** Most candidates correctly answered this question.

**(ii)** Most candidates were awarded at least two of the three available marks for drawing the line on the graph.

**Q5** In this QWC question most candidates could name and describe several of the steps in the formation of fossil fuels, or how the carbon in fossil fuels is returned to the atmosphere in the carbon cycle and therefore were awarded at least four marks. Others were able to give excellent well-structured answers and were awarded full marks for the question.

**Q6** **(a)** Most candidates drew a correct diagram in Stage 2 but in stage 3 fewer then went on to show the enzyme as the same structure as in the original diagram, along with diagrams of two separate products.

**(b)** Many candidates gave the correct answer of lock and key.

**(c)** **(i)** This part of the question was well answered by many candidates who focused on what would happen with a decrease in concentration of enzyme. There were some incorrect answers here linked to the effect of changes in temperature on an enzyme reaction.

**(ii)** The majority of candidates could give two other factors that affect the rate of an enzyme reaction.

**(d)** Answered correctly by many candidates.

**Q7** **(a)** Most candidates gave a correct answer.

**(b)** **(i)** Most diagrams drawn by candidates did show that the balloon had increased in size.

**(ii)** Many candidates answered this part of the question correctly.

**(c)** This proved a challenging question for some candidates. It differentiated between those who realized that glucose was present at the start of the investigation and was used up during the investigation and those that did not.

**(d)** This part of the question was correctly answered by many candidates.

**(e)** **(i)** Most candidates were awarded some marks in this question which compared aerobic and anaerobic respiration but only the better candidates were able to gain all the four marks.

**(ii)** Many candidates did not give a correct answer here.

**Q8** **(a)** Most candidates were awarded at least two of the possible four marks here.

**(b)** Only the most able candidates answered this part of the question on the nitrogen cycle correctly.

**(c)** **(i)** A correct answer was given here by most candidates.

**(ii)** Many candidates were able to correctly identify denitrifying bacteria and explain their function in the nitrogen cycle.

**Q9** As already stated in the general comments on this paper this question was discriminatory with the full range of marks being awarded to the candidates. Some candidates were also confused about the colours of the hydrogencarbonate indicator and a few gave incorrect colours that are usually associated with the results of tests for foods e.g. brick red or blue-black.

# Paper 2 Chemistry

## Assessment Unit 1 Structures, Trends, Chemical Reactions, Quantitative Chemistry and Analysis

### Foundation Tier

This was the 8th sitting of the new DAS Unit C1 exam. The May 2020 examinations had not taken place. A wide range of marks with few very low marks was evident and many very good responses were provided. There was little, if any, evidence of Foundation Tier candidates being entered at the wrong tier. The paper was successful in providing opportunities for candidates of differing abilities to respond positively.

*General note: Use of the Glossary of Terms.*

*In addition to the wording in the DAS Specification, CCEA has produced a Glossary of Terms for DAS: Chemistry. The Mark Schemes now reflect the actual wording provided in these two documents when questions relating to definition or understanding of a "term" are asked.*

**Q1** This question was about acids, indicators and the reaction of an acid with a carbonate. Part (a)(i) asked candidates to complete a table about the colours of some indicator papers with a strong acid, a weak acid and a strong alkali. It was poorly answered. Only a minority knew the colours of red and blue litmus in acid and alkaline solutions and again, only a minority knew the colour of universal paper in a weak acid. In Part (a)(ii) most deduced that a pH meter is used to accurately test the pH of a solution and in Part (b) most knew that all acids contain hydrogen ions.

Part (c), which covered the reaction of sodium carbonate with hydrochloric acid was poorly answered. Very few foundation tier candidates could name all three products though about half gave two correct products in their answers. Answers to the observation part of the question were very good and most gained both available marks.

**Q2** This question was a good discriminator. In Part (a) better candidates were able to gain all three marks by selecting words, from a list, to complete a sentence giving the definition of an alloy and in (a)(ii) they were able to deduce that only substance Y could be an alloy because it was the only mixture which was a mixture of elements containing a metal.

Again, in Part (b) better candidates were able to select, from a choice of three each time, the words needed to complete two sentences relating to a property of ionic substances and to the structure and uses of diamond.

Part (c) tested understanding that carbon forms four covalent bonds. Only a minority worked out that only two of the six structures shown could contain a carbon atom.

**Q3** Of all the QWC questions which have been asked at foundation tier since the introduction of the new specification, this six mark question about the structure of a beryllium atom produced the best responses. Many candidates gained 4 or all 6 marks available and it was quite rare to find responses worth two marks or less.

**Q4** This question was also a good discriminator. The definition of a compound, in Part (a) produced variable responses. In Part (b) most could identify the formulae of two compounds from a choice of five formulae.

Part (c) required candidates to work out, from given formulae the number of elements present, the total number of atoms in the formulae and to deduce the name of a compound from its formula. Better candidates gained all 3 marks.

Part (d) proved to be very difficult for most candidates and it was rare to see the correct state symbols given for all four substances in a given formula equation, even though the stem had identified three of the four substances as a solid, a solution and a gas and the fourth substance was water.

In Part (e) better candidates were able to balance a simple formula equation.

**Q5** The first part of this question tested knowledge of the Periodic Table and was well answered. Most candidates gained both marks available. Part (b) proved to be more challenging for many. Candidates were provided with a table of data which showed the melting points and boiling points of elements A, B, C and D. Most had difficulty working out which was a gas – it had a melting point of -101 °C, or which could be bromine – only one was a liquid.

In Part (c) around half the candidates could complete the word equation to give both products from the reaction of lithium with water. Many gained all three marks in (c) (ii) by working out that lithium is less reactive than potassium, that both are alkali metals and that the reactivity of elements depends on outer shell electrons.

**Q6** This nine mark question about bonding and structure was very well answered. Nearly all candidates correctly drew the electronic configurations of a magnesium atom and of a fluorine atom and it was common to see good explanations, in terms of the electrons involved, as to how magnesium and fluorine atoms react to form magnesium fluoride.

In Part (b) the majority of candidates gained all 3 marks for their dot and cross diagrams of a chlorine molecule.

**Q7** This question covered calculations involving relative formula masses, moles and moles to mass.

Part (a) asked for three relative formula masses to be calculated. Many gained at least 2 marks but there were sometimes arithmetical errors which prevented candidates gaining all 3 marks. Part (b)(i) asked candidates to calculate a number of moles from a given mass and given relative formula mass. One of the marks available was for demonstrating an ability to give the answer to two decimal places and better candidates were able to do this.

In (b)(ii) better candidates were able to multiply 0.125 by 120 to calculate a mass.

**Q8** This chromatography question proved to be the most challenging for many candidates. The specification expects that candidates will have had opportunities to carry out investigations using paper chromatography and that, at foundation tier level, they will be able to interpret a paper chromatogram but are not expected to calculate $R_f$ values. Interpretation of chromatograms implies familiarity with what a chromatogram looks like. This includes being able to use correct scientific terminology to identify, for example, the base line (or origin) and the solvent front. Some candidates struggled with Part (a) because they could not name these lines. In Part (b) most could work out that dye 2 did not contain dye A. In Part (c) most candidates worked out, or guessed, that dye C was the most soluble in the solvent and better candidates were able to explain why they had come to that conclusion.

Part (d) tested understanding of the fact that the spot is not started at the bottom of the paper by asking candidates to calculate the distance a spot had moved. Many candidates did not realise that they had to measure a distance which started at 1 cm on the ruler.

## Higher Tier

This was the 8th sitting of the new DAS Unit C1 exam. The May 2020 examinations had not taken place. A wide range of marks with few very low marks was evident and many very good responses were provided. There was little, if any, evidence of Higher Tier candidates being entered at the wrong tier. The paper was successful in providing opportunities for candidates of differing abilities to respond positively.

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**Q1** This chromatography question was generally well answered. The specification expects that candidates will be able to interpret a paper chromatogram and to calculate $R_f$ values. In Part (a) some candidates were not able to use correct scientific terminology to identify the base line (or origin). In Part (b) nearly everyone could work out that dye 2 did not contain dye A, and went on to explain in Part (c) why dye C was the most soluble in the solvent.

A very common error, in Part (d) was to measure the distance moved by the solvent and the spot from the bottom of the chromatogram rather than from the base line. Some candidates correctly measured one from the base line but then measured the other from the bottom of the paper. It was rare to find candidates scoring both marks in Part (d). Where candidates had made the same error twice i.e. giving 7.5 and 4.5 as their answers instead of 6.5 and 3.5, error carried forward (ecf) was applied and 1 mark was awarded. In marking Part (e), ecf from Part (d) was used so that candidates were rewarded for their ability to use the correct method to calculate $R_f$ even if they were using the wrong value or values from Part (d).

**Q2** This question covered the properties of some elements and focused on the alkali metals.

In Part (a) whilst most candidates were able to identify the liquid element, most also thought that potassium had a high melting point (842 °C) rather than a low melting point (63 °C.)

Whilst most realised in Part (b)(i) that lithium hydroxide and hydrogen were the products some gave a wrong formula for lithium hydroxide and, of those who got all formulae correct, some found balancing a symbol equation to be a challenge. Part (b)(ii) was very well answered; most candidates gained all 3 marks.

For Part (c) section 1.6.12 of the specification requires candidates to know and understand that alkali metals have similar chemical properties because, when they react an atom loses an electron to form a positive ion with a stable electronic configuration. Better candidates gained both marks. They conveyed clearly that the alkali metals (all) lose one electron [1] to become stable/achieve a full outer shell [1]. There is no credit for stating that they have similar chemical properties because they have the same number of electrons in their outer shell.

**Q3** Part (a) of this question asked candidates, in effect, to convert a word equation to a formula equation. Only better candidates managed to gain all 3 marks available. It was common to see potassium carbonate written as $KCO_3$. In all DAS Chemistry "writing balanced symbol equations" questions it is only possible to gain the balancing mark if all the formulae are correct. In part b(i) few candidates correctly identified two terms which apply to the reaction between potassium hydroxide and hydrochloric acid. Displacement or oxidation were often identified instead of exothermic.

If Part (b)(ii) only the most able candidates recognised that they just had to write an ionic equation for a neutralisation reaction. Some gave a balanced symbol equation for the reaction.

**Q4** This question was also a good discriminator. In Part (a)(i) many were able to gain the full 3 marks for observations of the reactions of magnesium with nitric acid but, in (a)(ii) only the better candidates gave the correct formula for magnesium nitrate.

Part (b) was only well answered by top candidates. In (b)(i) they were able to work out that the solution with the lowest pH was "A" and conveyed the idea that it had the highest concentration of hydrogen ions or highest percentage of hydrochloric acid to water. In Part (b)(ii) one mark was awarded for the idea of being completely ionised in water and many gained this mark but in order to gain the other mark candidates needed to explicitly state that hydrogen ions are present.

**Q5** Although, in Part (a) most candidates gave a correct definition of an alloy some gave definitions of a formulation, which did not gain credit. In Part (b) a majority realised that, of the six diagrams only two could represent a carbon compound. Many were unable to eliminate all the compounds shown in which "X" did not have four bonds.

Part (c) proved to be very challenging. Even though Section 1.3 of the Specification covers the four types of structures encountered i.e. ionic (or giant ionic), molecular covalent, giant covalent and metallic, many of the answers seen used other incorrect terms and the question proved to be a good discriminator. The most able candidates gained 4 or all 5 marks.

**Q6** The first three parts of this 12 mark question about bonding and structure were very well answered. Nearly everyone correctly drew the electronic configurations of a magnesium atom and of a fluorine atom and it was common to see good, 4 mark, explanations, in terms of the electrons involved, as to how magnesium and fluorine atoms react to form magnesium fluoride. Most candidates could correctly draw a dot and cross diagram for water and a slightly smaller proportion repeated their success with the oxygen molecule. Some however only drew a single bond between the atoms.

In Part (c) only the top candidates drew the triple bond notation for the nitrogen molecule.

**Q7** This QWC question about the structure of the $P^{3-}$ ion proved to be a good discriminator. Candidates needed to identify the name and number of each type of particle in the ion. Many gained all three indicative content points and most gained two. In the second section only a small proportion suggested an appropriate name for the ion; phosphide was correct. Most worked out the 2, 8, 8 electronic configuration and some knew or worked out that argon was the element with that electronic configuration. The final section was the most challenging and discriminated between those who ended up with middle band marks, 4 or 3 and those who answered the final section well to complete a very good answer and end up with 6 or 5 marks.

The top candidates knew why $P^{3-}$ could not be described as an atom. More candidates knew that $P^{3-}$, $O^{2-}$, and $F^{-}$ are all examples of anions.

**Q8** The final question covered different aspects of quantitative chemistry with 11 marks on offer. This question also proved to be a good discriminator.

In Part (a) most candidates were able to work out the relative formula masses of both compounds, some thought that the answer for $Ca(HCO_3)_2$ was 146 instead of 162, because they used 5 oxygens rather than 6 in computing their answers.

In Part (b) most were able to work out the number of moles from a given mass of a substance whose relative formula mass was given and could also work out the mass if the number of moles was given.

There were 3 marks available for Part (c)(i) which required candidates to work out and use a 3:1 ratio between the products whose mass was required and a reactant whose mass was given. Only the most able candidates found and used the correct ratio. If an answer was worked out and there was only one error, e.g. using a 1:1 ratio, it was possible to gain 2 method marks.

Part (c)(ii) required candidates to calculate a percentage yield. Provided that they used the correct formula and their answer to (c)(i) it was possible to gain both available marks, even if the (c)(i) answer had been wrong. Some candidates did not multiply by 100. If there was no attempt to calculate a percentage, or if the wrong formula was used e.g. with the theoretical yield on the top line, then no credit could be given.

In Part (c)(iii) many candidates appeared not to have read the question accurately. Answers which related to loss in separation or the purity of reactants were not credited.

# Paper 3 Physics

## Assessment Unit 1 Motion, Force, Moments, Energy, Density, Kinetic Theory, Radioactivity, Nuclear Fission and Fusion

### Foundation Tier

The examiners were aware that this has been a very difficult period for many candidates and this was reflected in the wide range of marks. It was obvious that, in a number of cases, schools did not cover the Unit 1 course completely.

**Q1** Four marks out of six was common with candidates not recognising that, with the microphone, sound is the input energy and electrical energy is the output.

**Q2** Part (a) was well answered. Part (b) caused difficulty with confusion between final and initial speeds. Some candidates confused the equation with the average speed equation and inserted 2 on the bottom line instead of time.

**Q3** In Part (a) the equation for a moment was well known but often the distance was given as the diameter of the wheel rather than "distance from the pivot" i.e. the radius.

In Part (b) candidates could often locate the centre of gravity successfully on the rectangle and on the disc but were very unsure of the ring with many placing an X on the ring rather than at the centre.

**Q4** Well answered.

**Q5** Well answered. Most candidates now realise that the numerator of the equation for efficiency should include the word "useful".

**Q6** Performance on this QWC question varied greatly. The probable reason is that, in many instances, the candidates simply hadn't covered this material.

A significant number of candidates thought that energy, rather than helium, was the major by-product of fusion.

**Q7** Well answered.

**Q8** In Part (i) the calculation of potential energy was well done by most but a significant number of candidates wrote Ep = mxh and so forfeited partial credit.

**Q9** The equation for power is well known but a failure to convert 210 cm to m was a common error.

### Higher Tier

The examiners were aware that this has been a very difficult period for many candidates and this was reflected in the wide range of marks. It was obvious that, in a number of cases, schools did not cover the course completely.

There was a wide range of marks with some scoring less than 20 and a number, pleasingly, scoring 70/70.

Examiners reported that there was a good range of questions to suit all abilities. All questions were attempted by the vast majority of candidates.

**Q1** Performance on this QWC question varied greatly. The probable reason is that, in some instances, the candidates simply hadn't covered this material - the Section on fusion is at the end of the specification. Nevertheless a significant number scored 6/6.

A number of candidates thought that energy, rather than helium, was the major by-product of fusion.

**Q2** Well answered.

**Q3** Part (i) well answered.

In Part (ii) candidates had to recognise that Ep = Ek before calculating the velocity.

**Q4** In Part (a) the equation for power is well known but a failure to convert 210 cm to m was a common error.

Part (b) well answered.

**Q5** **(a)** **(i)** Many candidates know that distance = area under the graph but a number were unable to calculate this area correctly. An alternative method was to use distance = av. vel x time.

**(b)** The equation for acceleration was given correctly but substitution was made from the wrong part of the graph - maximum acceleration occurred in the first 2 seconds.

**Q6** **(a)** Well answered.

**(b)** The questioned stated that the load was shared equally between the two springs but many candidates did not divide the 1200 N by 2 before applying Hooke's Law. A number did analyse the situation correctly and scored well.

**Q7** Well answered with many candidates scoring maximum marks.

**Q8** This was a challenging question and so it was pleasing to see that a fair number of candidates scored full marks. Those who found the total weight of 1440 N scored 3/4.

**Q9** **(a)** Most candidates calculated the weight correctly. This was meant to allow the candidate to calculate the resultant force (i.e. 5000 N) on the helicopter for an F = ma calculation. The most able candidates scored well here.

**(b)** Well answered.

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