

GCSE



**Chief Examiner's Report**  
**Science Single Award**

March Series 2018





## Foreword

This booklet outlines the performance of candidates in all aspects of CCEA's General Certificate of Secondary Education (GCSE) in Single 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](http://www.ccea.org.uk).



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# GCSE SINGLE AWARD SCIENCE

## Introduction

February 2018 was the first series in which the New (Revised) Specification was examined. There are significant differences in content between the Legacy and New Specifications: in addition, Higher Tier papers are now 60 marks, in common with the Foundation Tier papers. This report contains information as to how candidates performed in each of the six papers in this series. In the main, candidates did well, although there was significant variation in performance between different centres.

## Chief Examiner Report

### Assessment Unit AS1: Biology

#### Foundation Tier

This paper was generally well answered and allowed candidates of all abilities to respond positively to the questions. There was no indication that candidates ran out of time. The language appeared to be appropriate for all students.

- Q1** The effects of drinking alcohol and smoking were covered in this four-mark question. In Part (a)(i), most candidates could answer that the liver is the organ most likely to be harmed by drinking too much alcohol. Similarly, most candidates were familiar with and understood the term binge drinking. In Part (b), a significant minority of candidates answered tobacco instead of tar as the substance in cigarette smoke that causes lung cancer. The harmful effect of nicotine was well answered.
- Q2** The female reproductive system and the development of the foetus in the uterus were tested in this question. Many candidates scored well with a significant number obtaining seven or more of the nine marks available. In Part (a)(i), a significant minority of candidates misidentified the oviduct as the ovary and/or the vagina as the cervix. In Part (b)(i), a significant number also lost the mark through identifying X as the umbilical cord rather than the amnion. Parts (ii) and (iii) were generally well done.
- Q3** This question on human weight and variation involved calculating a percentage. In Part (a)(i), surprisingly few candidates were able to calculate the number of people whose weight was above normal. Even fewer could calculate the percentage of people who were obese (Part (ii)). A higher number of candidates were able to give evidence that the information provided displayed discontinuous variation.
- Q4** Drug and medicine testing was covered in this five-mark question. Part (a)(i) proved to be very discriminating with many candidates losing the mark through their answer being too vague. Candidates were credited with either stating that animal testing allows drugs and medicines to be tested on living organisms (rather than cells and tissues), or that animal testing is a safety stage that could pick up major problems before testing on humans. The mark was not awarded for answers such as 'it avoids testing on humans' as this suggests that animal testing replaces human testing which is not the case. A higher proportion of candidates were successful in Part (ii), giving good answers for the arguments against animal testing. The three-mark Part (b) produced mixed responses, with a majority of candidates failing to identify clinical testing as the name of the testing stage immediately before licensing. However, many candidates did well in the remaining part of the question by understanding that the stage involved testing on humans and that it was to check the best dosage or to identify side effects on humans.

- Q5** Candidate performance was again mixed in this seven-mark question on cells. Most candidates could identify X as the nucleus in Part (a)(i). A majority could also answer that root cells would not have chloroplasts as these cells receive no light and therefore couldn't photosynthesise. Part (iii) discriminated well – the more able candidates were able to appreciate that water moving from outside the cell into the vacuole had to pass through the cell wall, cell membrane and cytoplasm (in that order), but not necessarily through the nucleus or chloroplasts. Part (iv) was well done and most candidates could name two structures that were also present in animal cells. A minority of candidates was able to describe the function of stem cells.
- Q6** Biodiversity in the context of fishing quotas was tested in this question. In Part (a), only a small number of candidates were able to accurately define the term biodiversity. The calculation in Part (b)(i) was correctly answered by a small minority of candidates who appreciated that the data was in thousands. The remaining parts were often quite well done.
- Q7** This question on glucose regulation and diabetes was the first of the questions that were common with the Higher Tier paper. As with many questions in the paper, parts were well answered and other parts less well so. Most candidates appreciated that a sugary meal had been taken at point X in Part (a)(i). Part (ii) was less well done with only a minority of candidates knowing that glucose is converted to glycogen in the liver. Part (b) was answered much better; most candidates had a good understanding of the impact of diabetes and the difference between Type 1 and Type 2 diabetes.
- Q8** Photosynthesis was the topic in this question which was common with the Legacy Foundation Tier paper. In Part (a)(i), a majority of candidates could answer that layer A was closer to the light source and that it would receive more light than layer B. A minority of candidates failed to get credited through giving answers that were not specific enough such as there was more light reaching the top of the leaf (rather than making reference to layer A). Many candidates were able to pick up the second mark by stating that layer A had more chloroplasts (than layer B). Part (a)(ii) was not as well answered with a significant number of candidates failing to answer carbon dioxide as the gas that is used in photosynthesis. Part (b) required candidates to name two products of photosynthesis. Candidates secure in their knowledge of photosynthesis scored well here whereas those less secure fared badly.
- Q9** Part (a) required candidates to describe how colds and flu can be transmitted among people. This was generally well done. In Part (b)(i), many candidates could suggest why elderly people are offered a flu vaccination each year and a significant number made reference to them having a weaker immune system. Similarly, Part (b)(ii) which asked candidates to suggest why a vaccination to protect against colds has not been developed was often well done. Most candidates could use the information provided to state that colds were less harmful than flu. Part (c) asked candidates to analyse a graph showing how antibody level changed following an initial and then a subsequent infection. A significant number of candidates lost marks as they produced definitions of primary and secondary immune responses rather than using the information provided as required. Few candidates were able to make reference to memory lymphocytes in Part (ii).
- Q10** The six-mark QWC question tested the structure and function of chromosomes. Most candidates scored at least two marks but very few provided enough key points to get into the top band and therefore were denied access to the top marks. Most candidates were aware that chromosomes occurred in pairs, determined traits or characteristics and that Down's Syndrome was an example of a genetic condition caused by having an incorrect chromosome number. Many dropped marks through not been secure in their understanding of the links between chromosomes, genes, DNA and the double helix. For example, a minority of candidates made reference to 'DNA being formed of chromosomes' or 'chromosomes being part of genes'.

## Higher Tier

The overlap questions were well answered by the Higher Tier candidates, who did much better than Foundation Tier candidates in these questions. For example, many more Higher Tier candidates achieved full marks in the QWC question four. This seems to indicate that candidates were generally entered for the correct tier. There was no indication that candidates ran out of time and the language seemed appropriate for this level.

- Q1-4** In general the same comments to the common questions written in the Foundation Tier section of this report apply to the Higher Tier paper, except that Higher Tier candidates did much better as indicated above.
- Q5** This seven-mark question on biodiversity tested some of the new specification content. A significant number of candidates were able to define a 'brown-field building site'. Part (b)(i) was also well done in that almost all candidates were able to answer that the biggest increase in their use was between 2005 and 2010. Part (b)(ii) proved to be much more problematic, with only a small number of candidates being able to calculate the percentage increase between 1995 and 2015. Most candidates could appreciate that the use of brown-field sites saved the removal of forests or the loss of other natural habitat (Part (iii)). In Part (c), the more able candidates were able to answer that nature reserves can help conserve rare or endangered species or habitats; educating the public about nature was also an acceptable answer.
- Q6** This question covered reproduction and again included some new specification content. Part (a) was usually well done, with most candidates knowing where ova are produced and where fertilisation takes place. Fewer candidates were able to name the zygote as the cell labelled X in the diagram and be able to define the term haploid (Parts (b) (i) and (ii) respectively). Similarly, only a small number of candidates could work out that there were four diploid cells in the diagram.
- Q7** This six-mark question on the nervous system and genetics was generally quite well answered, although very few candidates scored full marks. In Part (a), very few candidates obtained both marks but many correctly answered either receptors in Part (i) or spinal cord in Part (ii). In Part (b)(i), a majority of candidates could write the genotype of a heterozygous taster. In Part (ii) many candidates could complete the Punnett square correctly. However, a significant minority of candidates based their cross on both parents being heterozygous, rather than answering the question as it was asked. Part (iii) proved to be discriminating, with only a minority of candidates taking account of the fact that the question specified a 'girl', therefore producing a probability of 25%.
- Q8** Respiration and the effect of exercise on the heart were tested in this eight-mark question. In Part (a), only the more able candidates were able to accurately complete the balanced symbol equation for respiration. Part (b)(i) proved to be equally demanding with very few candidates being able to calculate the rate of increase of pulse rate. Part (ii) was also poorly done with relatively few candidates obtaining more than one of the three marks available. Many candidates failed to appreciate that the increased pulse rate is necessary to deliver more blood carrying more oxygen and glucose to the muscles for the higher level of energy required during exercise. Part (c), asking for one way in which exercise benefits the heart was usually well done.
- Q9** Natural selection, endangered and extinct species were tested in this nine-mark question. Only those candidates who provided full trends obtained the two marks available for Part (a)(i). Part (ii) asked candidates to deduce from the graph when the lawn started to be cut at a lower level. Many candidates were able to answer this correctly, linking the sudden reduction in species number to closer cropping. Part (iii) was often well done, with credited answers stating that different plant species

appear at different times of the year. The three-mark Part (b) was usually very poorly answered. Many answers were generic, defining the principle of natural selection, rather than applying their understanding to the examples used in this question. However, Part (c) was very well done, with a strong majority of candidates being able to accurately describe the differences between the terms endangered and extinction.

## Assessment Unit 2: Chemistry

### Foundation Tier

This paper was the first of the new specification suite of papers and allowed candidates to show their knowledge and understanding in different parts of questions, with responses ranging from quite poor to excellent. Many examiners commented that most candidates attempted all questions, leading to the conclusion that questions were accessible to the majority of candidates. The paper had a balance of new material, which seemed to have been taught well by teachers, and more familiar content. In general, candidates scored well in questions at the beginning of the paper, especially Questions 1 and 2. Questions 5 and 10 provided challenge for most Foundation Tier candidates thus acting as effective discriminators, with sections of Question 9 also differentiating effectively between candidates.

- Q1** This question was about hazard symbols and their meaning. This was very well answered by a majority of candidates. Although some candidates simply named the hazard symbol in Part (b) rather than describing the effect on human skin.
- Q2** This question centered on the topic of forensics and fighting crime. A large number of candidates correctly identified the whorl fingerprint in Part (a)(i) but were unsuccessful in identifying the loop fingerprint in Part (ii). Part (b) based on collecting a fingerprint at a crime scene was well answered as was Part (d) which was based on collecting fibre evidence. Part (c) was based on new content from this part of the specification and was generally well answered.
- Q3** This question was on the topic of elements and changes of state. The majority of candidates scored well in Part (a) which required the identification of different changes of state. Part (b) was less successfully answered; it required candidates to define the terms element and sublime - these were clearly not well learned.
- Q4** This question on the new topic of separating techniques was usually quite well answered. It was pleasing to see that many candidates were skilled in drawing apparatus; candidates should be encouraged to use a ruler when drawing straight lines and to label each piece of apparatus carefully. Part (b) was well answered.
- Q5** This question tested the topic of acids, bases and chemical indicators. In Part (a), candidates found it difficult to describe what an indicator was, many simply stated it showed if something was an acid or alkali and omitted to say that it changed colour. Part (b) was based on making an indicator and was surprisingly poorly answered despite having been asked on previous question papers. In Part (c), a large number of candidates simply did not read the question carefully and inserted the colour of universal indicator rather than that of the blueberry indicator. In Part (d) candidates often referred to both liquids being the same colour. This did not gain a mark as it needed to be clear that it was the indicator that changed to the same colour in both liquids. Part (e) was well answered with most candidates knowing that a pH sensor is more accurate than a chemical indicator. Those that wrote that it was more reliable did not gain credit.

- Q6** This six mark QWC question covered the reaction of alkali metals with water. While there were very few blank responses, most candidates did not score more than four of the six marks available. Many candidates listed safety precautions such as tie long hair back, push in stools, wear aprons; these were not given credit. In some answers the candidate did not clearly state similarities and differences in the two reactions and simply listed observations. In Part (b) candidates were required to complete the word equation for the reaction of sodium with water; this proved challenging for many candidates, the majority of Foundation Tier candidates scoring either zero or one of the possible two marks.
- Q7** This question was based on the topics of atomic structure and the Periodic Table. In Part (a), candidates were asked to state the order in which Mendeleev placed the elements and this was fairly well known. Part (b) required candidates to identify the name of the Group of elements not found in Mendeleev's table - some candidates named the wrong group and others gave the Group number rather than the name. Parts (c) and (d) were well answered in the majority of the papers.
- Q8** This question covered the reaction of hydrochloric acid with calcium. Many candidates were unable to identify the two products of the reaction in Part (a), some selected three products and so lost one of the possible two marks. Part (b) is new to the specification and it was pleasing to see that many candidates correctly answered exothermic as the type of reaction that causes an increase in temperature.
- Q9** This question involved drawing a line graph for results of an experiment. In Part (a), the graph on the whole was attempted to a fairly good standard, the most common mistakes were in not plotting the (0, 0) point and in not adding a correct smooth curve to join the points. A small number of candidates drew a bar chart and this did not gain any credit. In Part (b), the most common score was one mark out of two with candidates often only stating half of the trend; that is either the volume of gas increased with time or the volume of gas remained constant after 40 seconds. Part (c) was poorly answered. Many candidates simply did not know that limewater was the chemical used to test for carbon dioxide and hence did not know the colour change. Of those candidates who knew the colour change, many wrote clear rather than colourless and this did not gain any credit. Part (d) is a common style of question on this paper in which candidates were asked to identify the number of elements and atoms represented by a formula. It proved quite challenging for Foundation Tier candidates with many mixing up the two answers.
- Q10** This question was based on the topic of hydrocarbons. Surprisingly, in Part (a) very few Foundation Tier candidates were able to describe two effects of increasing the amounts of greenhouse gases. There were a number of incorrect answers, the most common being that the ozone layer would be affected. Part (b) also proved challenging; in Part (i) candidates were asked to draw the structural formula of butane and a common mistake was to omit the bonds between the central carbon atoms. In Part (ii) the molecular formulae for methane and propane were not well known.

## Higher Tier

Overall, candidates performed fairly well in this Revised Specification paper. The new style paper now only contains one opportunity for the assessment of QWC and is marked out of a total of 60 marks. The paper was an effective discriminator among candidates, with responses ranging from excellent to poor. Many of the candidates who had prepared well for the examination scored highly and their knowledge of the content covered in this paper was evident throughout. However, at the lower end of the mark range it was clear that some candidates would have been better suited to sitting the Foundation Tier paper.

- Q1-3** These questions were common to both Higher and Foundation Tier papers. The responses to these questions were generally better at Higher Tier than Foundation Tier.
- Q4** Parts of this question were also examined in the Foundation Tier paper; Higher Tier answers were generally better for these parts. In Part (a), candidates were asked to describe the formation of crude oil. A common mistake was that candidates misunderstood the question and described the separation of crude oil by fractional distillation. In Part (b), candidates were asked to complete a word equation for the combustion of butane; most scored one of the two available marks. Parts (e) and (f) were good discriminatory questions with only the most able candidates scoring all six available marks. Part (e) asked candidates to explain polymerisation in terms of the starch molecule. Candidates mostly scored one of the two marks, the majority failing to mention that there were many glucose molecules joined in the chain. Part (f)(i) asked for the completion of the balanced symbol equation for the polymerisation of PVC. Many candidates failed to score any marks in this question due to inaccurate drawing of the structure such as the single bonds on each carbon not extending through the square brackets. In Part (f)(ii), many candidates simply gave a definition of a hydrocarbon rather than explaining why vinyl chloride was not a hydrocarbon.
- Q5** This question focused on rates of reaction, a new topic to this specification. In Part (a), a gas syringe as a piece of apparatus used to measure gas volume was not widely known. Part (b) involved interpreting a line graph. In Part (c), candidates were asked to use particle theory to explain why a reaction at higher temperature would be faster. Many failed to use the correct terminology and so did not gain full marks. Part (d) was well known.
- Q6** This question was based around information given to candidates on the reactivity of different metals. This was a very well answered question with the majority of candidates scoring at least three of the five marks available. The most common error was in Part (c) where some candidates did not reference both hot and cold water in their explanation.
- Q7** This question was based on electrolysis. It was answered with varying degrees of success. Most candidates scored fairly well in Parts (a) and (b)(i); conversely, Part (b)(ii) which asked for the ionic equation for the formation of oxygen was not well known.
- Q8** This question assessed the candidate's QWC and involved describing the structure of an atom and relating this to an element's atomic number and mass number. Many candidates scored well in this question. However, a number of candidates were unable to define the atomic number and the mass number. A common error was to refer to the atomic number as the number of protons and electrons, which is not correct. Some candidates gave the masses of each of the subatomic particles which was not asked for in the question and so this did not gain any credit.

## Assessment Unit 3: Physics

### Foundation Tier

In general, candidates performed well with most gaining their marks in the more straightforward questions at the start of the paper. However, the more complex standard demand questions at the end of the paper proved challenging for a significant number of candidates. All examiners passed remarks on how few blank spaces there were in papers, leading to the conclusion that each question was accessible to the majority of candidates.

- Q1** This question on heat transfer was very well received making it very obvious that this new topic on the specification had been taught well. In Part (a) candidates demonstrated good knowledge of convection while in Parts (b) and (c) good knowledge of conduction was demonstrated.
- Q2** This question on energy types, transfers and efficiency proved to be a good discriminator. In Part (a) most candidates knew that kinetic or potential energy was involved in the aeroplane taking off but they often had these wrong way round or used just one of these types along with nuclear. In Part (b)(i), most could calculate the heat produced by the battery but then found it difficult to calculate the light produced by the bulb. There were many efficiency answers greater than 1 in Part (c).
- Q3** This question on electric circuits was well received with candidates showing good knowledge of the voltage and current readings in a parallel circuit in Parts (a)(ii) and (iii). Part (a)(i) proved a little more difficult with most recognising that an ammeter was required but not knowing that it is connected in series. In Part (b), candidates could give good descriptions of how to use the test circuit to find a conductor and could classify materials as either conductors or insulators.
- Q4** This question on household electricity was also well answered by the majority of candidates who could deduce the fastest kettle in Part (a), keep the amount of water the same to ensure a fair test in Part (b) and that kettle C was the best value for money in Part (c). In Part (d) there was good knowledge demonstrated about the wiring of a 3-pin plug and most candidates knew that the earth wire was not necessary if the appliance was double insulated.
- Q5** This question on Space proved to be a good discriminator, with Part (a) proving difficult for most candidates who were unable to give clear unambiguous differences between the solar system model shown in the diagram and the modern-day model. In Part (b)(i) there was difficulty completing the trend shown in the table with many candidates choosing sets of numbers. Parts (b)(ii) and (iii) were more accessible with candidates able to complete the calculation on Earth orbits and naming another object found in our Solar System. In Part (c) most could complete the Earth weight correctly but most thought that zero weight also meant zero mass and so only achieved one mark in this part.
- Q6** This question on waves was a good discriminator with most correctly identifying either the amplitude or wavelength. Few got both correct in Part (a). In Part (b) most knew that transverse particles move at right angles to the wave and that the other type of wave was longitudinal. Part (c)(i) was accessible with most correctly stating the trend in the table. Few could read the table in Part (c)(ii) to find the speed of sound at  $-1^{\circ}\text{C}$  and then substitute this value into the given equation. Most knew the unit of frequency was the hertz in Part (c)(iii).

- Q7** This question on friction and stopping distance proved to be a good discriminator with many candidates unable to read the newtonmeter in Part (a)(i). A majority of candidates understood that the force opposing motion was friction but few knew that a lubricant would reduce friction. In Part (b), many candidates made a reasonable suggestion at the missing value in the table in Part (i), but fewer could correctly state the correct trends shown in Part (iii). In Part (ii) most candidates were aware that rain, snow and ice were examples of poor road conditions.
- Q8** This question on radiation was poorly answered by the majority of candidates. Most candidates understood that alpha and beta were the other types of radiation and that they could not penetrate lead and so gained full marks in Part (a). In Part (b), most candidates could describe that the count rate decreased as the lead got thicker but fewer went on to state that after 30 mm the count rate stayed the same.
- Q9** This question on electricity generation proved to be a good discriminator with most candidates able to gain 2 marks in Part (a), the six-mark QWC question through defining renewable or identifying the sources in the graph as renewable or non-renewable. It was pleasing to see the majority of candidates making an attempt at the QWC question. Some candidates were able to add at least one environmental disadvantage to achieve 4 marks. Very few could put all this together and state the trends shown in the graph to gain full marks. Part (b) was poorly answered by the majority of candidates who started describing the component parts of a power station rather than concentrating on the generator.

## Higher Tier

- Q1-4** These standard demand questions were common to the Foundation and Higher Tier papers. Generally, the performance of the Higher Tier candidates in these questions was better than the performance of Foundation Tier candidates. Higher Tier candidates were usually able to give fuller explanations in Questions 3(b), 4(a) and (b).
- Q5** This question on Space proved to be a good discriminator with most able to state one use of artificial satellites and state that gravity was the force that keeps satellites in orbit. Fewer gave two uses and explain gravity to gain full marks. In Part (b), most candidates could take readings from the graph in Parts (i) and (ii) but few were able to deduce that the total number of stars is increasing in Part (iii). In Part (c), the formation of a star was tested and many candidates gained one mark knowing that gravity pulls something together. Some also knew that nuclear fusion is involved, but only a very small minority understood that it was hydrogen clouds or nebulae that were being pulled together and so few achieved full marks.
- Q6** This question on heat transfer was poorly done. In Part (a) most candidates knew that conduction is how heat travels through solids, but not gases, but few knew about the free electrons that are necessary. In Part (b) some candidates understood that the use of the shiny, bright back of the fire is to reflect heat out and in Part (c) very few understood that convection makes particles speed up and spread out or that hot gas rises as it is less dense.
- Q7** This question on energy proved to be a good discriminator with most candidates able to state that kinetic energy was formed in Part (a)(ii), use the kinetic energy equation in Part (iii) and state at least half of the Principle of Conservation of Energy in Part (b). In Part (a)(i) many candidates had difficulty stating that the amount of potential energy decreases as the height decreases and in Part (ii) most could not state that heat and sound were also produced by the rollercoaster.

- Q8** This question on resistance was well received with most candidates able to state the unit of resistance as the ohm in Part (b)(i), plot the points on the grid in Part (b)(ii), state part of the trend shown by the graph in Part (b)(iii) and name another factor that affects resistance in Part (c). Some could also draw a smooth curve as a line of best fit and give a full description of the trend to gain more marks. Part (a) proved most difficult with only a small minority of candidates stating that current is the flow of electrons or that the electrons are negative.
- Q9** This question on force was well done with the calculations in Parts (a) and (c) usually being accurately completed. However, in Part (b) only a small minority of candidates understood that the force of air resistance could be reduced by decreasing the area exposed to the wind.

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