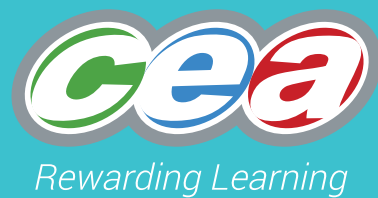


GCSE



Chief Examiner's Report
Single Award
Science

November Series 2022



Foreword

This booklet outlines the performance of candidates in all aspects of this specification for the November 2022 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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GCSE Single Award Science

Chief Examiner's Report

Subject Overview

The papers in this suite contained questions that allowed candidates of differing abilities to respond positively. The overall standard of answers was reasonable. Candidates were awarded a broad range of marks on all papers. Most candidates attempted all questions and there was no evidence that candidates had insufficient time to complete any of the papers. The language used in all examination papers appeared to be appropriate for all. The evidence from candidates' responses suggested their reading and interpreting information skills by comparison, with previous years' examinations, was of a lower standard. Candidates need to take care when drawing graphs, points should be plotted neatly or bars drawn carefully. For line graphs in biology, these should be dot-to-dot and in physics and chemistry the line should be a straight line or curve of best fit. Candidates also need to pay more attention to diagrams and question stems as these contain relevant information. It is important in QWC questions that candidates write sentences starting with a capital letter and ending in a full stop.

Assessment Unit 1

Biology

Foundation Tier

Overview

This paper had mixed answers and allowed candidates of all abilities to respond positively to the questions with few candidates leaving more than one or two parts of a question unanswered. This paper did reward those candidates who had a solid revision of key terms and facts while being a good over all discriminator for those who were able to apply their knowledge to more challenging questions. There was no indication that candidates ran out of time and it appears that all candidates were entered for the correct tier.

- Q1** This question was well answered and the cued question provided a positive start to the paper for all candidates. The most common wrong answer for Part (d) was 'telescope' instead of 'microscope'.
- Q2**
- (a)**
 - (i)** Identifying the prostate gland proved challenging for some candidates, although accepting just 'prostate' on its own opened the mark scheme up and allowed more candidates to be awarded the mark.
 - (ii)** A lot of candidates could not recall the function of the testes with the most common incorrect answers being 'hold the sperm' and 'protect the sperm' both of which did not gain credit on their own.
 - (b)** The majority of candidates correctly matched the method of contraception to its description.
 - (c)**
 - (i)** Most candidates successfully circled fertilisation however, in Part (ii) many candidates failed to recognise that the answer was 'zygote'. This is an example of definitions not being learned and successfully recalled by candidates.

- Q3 (a) (i)** Was answered correctly by the majority of candidates.
- (ii)** Considering that this question has been asked numerous times in the past, it was surprising that a significant number of candidates failed to explain that the arrows showed the flow / transfer of energy. Many candidates are still giving answers like 'what eats what' or 'what is consumed by what'.
- (iii)** Again surprising that so many candidates failed to correctly count up the number of separate food chains within this food web.
- (iv)** In Part (a) (iv) a number of candidates did not read the instructions and constructed a random food chain, one not linked to the information provided.
- (b) & (c)** Parts (b) and (c) were poorly answered. These are definitions directly off the specification and it was clear that many candidates had not learned them. The definitions of brownfield site were so varied and unrelated to the topic that it appeared some candidates had not covered this topic in enough detail.
- Q4 (a)** The answers were often vague with many citing 'food' as the source of salmonella rather than uncooked/contaminated food.
- (b)** Was poorly answered with many candidates failing to mention the microbes being trapped by the mucus, there appeared to be a lack of understanding of the distinction between preventing microbes entering the body and dealing with them once they are inside.
- (c)** The definition of antigens was given in the question – chemical markers, yet a number of candidates still could not identify them. Part (ii) was well answered.
- Q5 (a) (i)(ii)(iv)** Parts (i), (ii) and (iv) were well answered with the vast majority recalling the sources and/or functions of the nutrients listed.
- (iii)** Was a good discriminator with the better candidates successfully recognising pregnancy as the variable from the information given.
- (b)** The bar chart was well drawn and the majority clearly indicated the top of each bar and shaded the bars making it easy for examiners to mark.
- Q6 (a) (i)** Candidates found it hard to express their answers to this question. Most of the correct answers were given by stating 'Type 2 because you are born with Type 1'.
- (ii)** Was well answered with candidates identifying more exercise as a method to reduce the risk of diabetes.
- (b) (i)** Insulin correctly named by most candidates but Part (ii) was poorly answered- the most common wrong answers were 'insulin controls / regulates blood glucose levels', candidates failed to say clearly that blood sugar was lowered.
- (c)** Fatigue and thirst were common wrong answers given for this question indicating that a number of candidates confuse 'symptoms' and 'effects' of diabetes.
- Q7 (a)** Control variables were easily identified by the majority of candidates with most scoring at least 1 mark.
- (b)** Calculation completed successfully by most candidates.
- (c)** Candidates still have problems explaining or stating a trend. The most common error was to comment on the total mass rather than the average mass of each plant.

- (d) Most candidates correctly stated 15, indicating a good understanding of the table of information provided.
- Q8**
- (a) (i) Tar correctly identified by almost all candidates.
(ii) Most candidates incorrectly stated the ‘lungs’ as being effected by nicotine rather than the heart.
- (b) (i) Few candidates got 2 marks with many failing to identify that oxygen/ glucose cannot reach the heart muscle cells.
(ii) Many failed to answer the question often excluding themselves by referring to the heart rather than the heart muscle as mentioned in the question.
- (c) (i) Candidates found it challenging to give a trend, and did not refer to both the independent and dependent axis.
(ii) Answered poorly with many failing to read 20 and 3 from the graph. Of those who did read the values a significant number did not subtract to find the difference.
(iii) Only the very best candidates answered this part correctly and drew a conclusion from the graph. The most common mistake was to state a trend = to mix up Parts (i) and (ii)
- Q9**
- (a) Fairly well answered with the most common mistake being a restating of the information in the question – Ebola is a virus but failing to link the antibiotics with bacterial diseases.
- (b) QWC – Generally well answered with most candidates managing to score 2 marks.

Higher Tier

Overview

This paper was well answered and allowed candidates of all abilities to respond positively to the questions with few candidates leaving more than one or two parts of a question unanswered. This paper covered a wide range of the specification and it rewarded those candidates who had a solid revision of terms and facts while being a good over all discriminator for those who were able to apply their knowledge to more challenging questions.

There was no indication that candidates ran out of time. The language appeared to be appropriate for all. It appears that candidates were entered for the correct tier.

Question Number 1-3 (Overlap questions with GSA11)

In addition to the comments made on GSA11.

As expected all 3 overlap questions were better answered by higher candidates.

- Q1** Higher tier candidates were significantly better at stating a trend.
- Q2** More candidates scored 2 marks on Parts (b) (i) and correctly stating the trend in Part (c).
- Q3** A significant number of candidates scored 4 or 6 marks on the QWC question.
- Q4** (a) (i) Despite being asked on many papers before, candidates still found it difficult to formulate an answer to this question part. Teachers must encourage candidates to learn all key definitions on the specification to ensure they can access these recall marks.

- (ii) The vast majority of candidates gave the correct example of ‘tongue rolling’.
 - (iii) Well answered with the majority correctly identified the bar graph as the correct type.
- (b) There were mixed responses to this question with a surprising number of candidates unable to work out a percentage. This skill has been tested many times in previous papers, candidates should be encouraged to review past papers online.
- Q5** (a) The Punnett square was completed correctly by the vast majority of candidates as was the ratio in Part (ii).
- (b) Genetic definitions still prove a big stumbling block to many candidates. This part was very poorly answered.
- Q6** (a) (i) This was correctly answered by only the more able candidates who mainly identified the lack of a cell wall as the key reason.
- (ii) Chloroplast was correctly identified by the vast majority of candidates.
- (iii) Only the better able candidates linked the need for sunlight for photosynthesis with being close to the surface of the pond.
- (b) Again only the better able candidates scored 3 marks. Many scored 1 for O₂ but failed to complete the equation and balance it. There are only 2 balanced equations on the specification and candidates have been tested many times on them.
- Q7** (a) A substantial number of candidates failed to say what had been eaten so lost the mark.
- (b) Reasonably well answered – candidates correctly identified person A, but those that lost the mark did so by failing to compare the glucose level with B.
- (c) The graph was well plotted.
- (d) (i) – (iii) Details of insulin, where it is produced and its role was known by the majority of candidates.
- (e) The reasons for the rise in diabetes are well known and this question was well answered.
- Q8** (a) Many candidates lost marks for not putting arrow heads on the lines connecting the organisms.
- (b) Explaining natural selection has been tested many times in the past, but this question required candidates to apply the knowledge to a specific situation. Most responses gained 2 marks but failed to achieve the final marking point – that the blackbird is more likely to kill the orange-striped caterpillar.
- Q9** This question tested the candidate’s ability to interpret information from a graph and link it to information about human activity. It proved to be a discriminator with only the top scoring candidates achieving marks on this part.
- (a) (i) Once again stating a trend proved to be difficult with only a few candidates achieving both marks here.
- (ii) These top candidates managed to identify the ‘new technology’ as the cause of the trend but could not explain why.
- (b) An inability to clearly express themselves meant that few candidates scored marks on this question.
- (c) More candidates achieved one mark on this question but as in Part (a)(ii) they failed to clearly link the change in numbers to the cod.

Assessment Unit 2

Chemistry

Foundation Tier

Overview

In general candidates performed well in this unit. The paper included a good range of topics and was a good assessment of candidates' knowledge of Unit 2. The paper allowed for candidates of differing abilities to respond positively with most candidates answering all questions in a style that showed that they understood all the questions. The first seven questions were a mixture of multiple choice, matching pictures to words, single word answers and then progressing to writing definitions, explaining some simple procedures, drawing and interpreting graphs. These were mostly well handled. Questions 8 and 9 were more challenging and discriminated well between candidates of differing abilities. Despite the latter questions being more challenging, the majority of candidates attempted them and the more able candidates performed well. There was a noted improvement in the standard of answers compared to the previous two years. There was a wide range in marks with many candidates achieving an average mark of 50% or higher.

- Q1**
- (a)** Candidates were asked to identify the name given to warning symbols from a choice of 3. Majority of candidates answered correctly.
 - (b)** Candidates were given a hazard symbol and asked to name it. Generally this was well answered. Care needed with spelling of "corrosive".
 - (c)** Candidates were asked to draw the symbol for a toxic substance. Most candidates were able to draw a satisfactory drawing of the skull and cross bones. A small number of candidates omitted the cross bones and unfortunately could not be awarded the mark.
- Q2**
- (a)** Candidates were asked to link particle diagrams to the substance they represented. Most candidates correctly linked element for one mark. Fewer candidates correctly linked compound with many mistakenly joining it to mixture.
 - (b)** Candidates were asked to name the smallest particle making up all chemical substances. Not as well answered as hoped for – common wrong answers included "element" or subatomic particles e.g. "protons" or "electrons".
 - (c)** Definition of pure substance was not well answered – a relaxing of the original mark scheme allowed more candidates to achieve the mark.
- Q3**
- (a)**
 - (i)** Candidates were asked to draw the arrangement of particles in a solid. Generally, this was well answered with most candidates showing a regular arrangement of tightly packed atoms. Some candidates, whilst drawing a regular arrangement of atoms, the spacing between the atoms was too big and the mark could not be awarded. Several candidates did not answer the question which would suggest they had missed reading the question.
 - (ii)** This question identifying the letters to show different changes of state was very well answered by the majority of candidates.
 - (b)** The majority of candidates answered "sublimation" correctly. A noted improvement on similar questions in previous years.
- Q4**
- (a)** A simple calculation to work out the number of students with a loop fingerprint was well answered by the majority of candidates.
 - (b)** "Whorl" was well identified by most candidates – care needs to be taken with spelling, with some candidates writing "whirl" or "swirl".

- (c) Candidates were asked to describe how a fingerprint could be collected from a white surface. Most candidates knew carbon black powder was used and that cellotape was needed however, fewer candidates mentioned using the tape to lift the print. Some candidates incorrectly gave aluminum as the powder. Care needs to be taken not to use the wording from the question stem e.g., use cellotape to “collect the print”.
- (d) Candidates were asked to explain why fingerprints are useful in helping to identify a person. Most candidates answered this correctly stating that fingerprints are “unique” or other correct alternatives to this.
- Q5** (a) (i) Some candidates did not know how to calculate the number of protons and neutrons when given the atomic number and mass number. Higher ability candidates were able to successfully answer this question.
- (ii) The electronic structure of fluorine was well drawn by the majority of candidates.
- (b) (i) Candidates were asked for the name given to Group 7 elements. Halogens was correctly answered by most candidates.
- (ii) Candidates were asked why Group 7 elements had similar chemical properties. This proved a challenging question to a number of candidates with very few making the link to the number of electrons on the outer shell and similar chemical properties.
- (iii) Candidates were asked to name another element found in period 2. This was reasonably well answered with “chlorine” being a common answer for those candidates answering incorrectly.
- (c) This question asking candidates to identify the trend in melting points for some group 7 elements was very well answered this year and showed a noted improvement in identifying trends compared to previous years.
- Q6** (a) Candidates were provided with the information that hydrochloric acid is a strong acid and then asked to suggest the pH value for this acid. Many candidates answered correctly – unfortunately a small number of candidates gave a range of pH 1 – 3 and could not be awarded the mark. Another smaller number of candidates gave the opposite end of the pH scale with pH 12 – 14 being incorrect.
- (b) (i) Candidates were asked to complete a word equation to name the salt formed when sodium hydroxide reacts with hydrochloric acid. This was a good question for discerning more able candidates – of those answering incorrectly “carbon dioxide” was a common answer.
- (ii) Candidates were asked to name this type of reaction. Not as well answered as expected.
- (c) (i) Gas tests - Carbon dioxide was correctly answered by the majority of candidates.
- (ii) & (iii) Candidates were asked for the number of elements and atoms in a chemical formula - although better answered than previous years there are still many candidates getting mixed up between the terms atoms and elements.
- Q7** (a) (i) Candidates were asked to give the name for a compound containing hydrogen and carbon only. Hydrocarbon generally well answered.

- (ii) Candidates were asked to circle the name given to the type of bonding that takes place between hydrogen and carbon. This was one of the most poorly answered questions on the paper. Most candidates incorrectly gave “ionic” as their answer.
- (b) (i) Generally well answered – of those answering incorrectly “combustion” was a common answer.
- (ii) The word equation for the combustion of propane was generally well answered. Of those not achieving full marks many candidates were able to achieve one mark for “water”. A few candidates incorrectly gave “propane oxide” as their other answer.
- (c) The structure of propane was correctly identified by the majority of candidates.
- (d) (i) The formula for decane was excellently answered by all candidates of differing ability, albeit more likely due to continuing the sequence from the table rather than using the formula (C_nH_{2n+2}).
- (ii) The boiling point for decane was well predicted by most candidates.
- (iii) The bar chart was generally well attempted by the majority of candidates. Care needs to be taken in ensuring bars are of equal width and that a ruler is used. A few candidates were unable to correctly use the scale provided.
- Q8** (a) The QWC was assessed in this question that centered on making an indicator. This was well attempted by most candidates with the majority falling into band B and achieving 4 marks. Many candidates were able to correctly identify a suitable plant, recognised that it needed to be crushed / boiled and that an indicator changes colour when added to acids / alkalis. Many candidates listed general lab safety points rather than identifying safety points specific to this investigation. Fewer foundation tier candidates achieved the full six marks.
- (b) Very few candidates achieved full marks in this question. Of those achieving one mark, it was for recognising that universal indicator can tell the strength of an acid or alkali. Most candidates did not provide the information that universal indicator gives a wide range of colours. Many candidates referred to a wide range of pH / exact pH rather than the strength of acid / alkali. Many candidates incorrectly said that it was more accurate than other indicators.
- (c) (i) Generally well answered although a number of candidates incorrectly gave the answer “pH scale” here rather than “pH probe” or “pH meter”.
- (ii) Most candidates answered this correctly with “more accurate” or “gives a reading to one decimal place”.
- Q9** In general candidates found this entire question challenging. Care needs to be taken to read questions carefully and to answer the question asked. Knowledge around the topic of nanotechnology and nanoparticles was generally poor with only very capable candidates successfully answering these questions.
- (a) Candidates were asked to use information from the table to give a reason why aluminium was a better choice than steel and to explain their answer. Poorly answered with many candidates providing more than one reason and no explanation.
- (b) Whilst many candidates correctly identified “carbonfibre” as the correct answer, they went on to provide more than 2 reasons and could not be awarded the second mark. Many candidates simply listed all of this materials properties. A few candidates provided the name of a material that was not listed on the table.

- (c) (i) & (ii) The definitions of synthetic and photochromic were not as well known as expected. Synthetic was slightly better known. Many candidates defined a “smart material” in general rather than specifically “photochromic”.
- (d) Very poorly answered. Candidates gave answers relating to the general concerns around nanoparticles rather than specifically to their use in sun creams.

Higher Tier

Overview

In general candidates performed well. The paper included a good range of topics and was a good assessment of candidates’ knowledge of Unit 2. The paper allowed for candidates of differing abilities to respond positively with most candidates answering all questions in a style that showed that they understood all the questions. There was a noted improvement in the standard of answers compared to the previous two years.

Looking at the marks achieved it was evident that those at the lower end of the marks achieved would have been better suited to sitting the examination at foundation level. There was a good range in marks from very high to very low with a good spread between. Most candidates attempted all questions and there was no evidence that candidates had insufficient time to complete the paper.

- Q1 & Q2** The overlap questions (1 and 2) were generally completed to a higher standard than the same questions on the foundation tier paper.
- Q3 (a)** Candidates were asked to complete a table showing names and number of subatomic particles present in a sodium atom. The most common error here was to put the names in the wrong order.
- (b) Most candidates were able to draw the electronic structure of a sodium and chlorine atom accurately. A few candidates used the diagrams to try and show how bonding occurred between the two elements but this was not what the question asked for.
- (c) (i) Most candidates were able to explain how sodium chloride is formed in terms of electrons. A few candidates mentioned “sharing” electrons and lost both marks.
- (ii) & (iii) Both of these question parts were not particularly well answered indicating either a lack of knowledge in the subject of ions or a misinterpretation of the questions. Many candidates gave the electronic configuration of a sodium atom rather than a sodium ion.
- Q4 (a) (i)** Candidates were provided with a table of results and asked to plot a line graph. The plotting of points was successfully done by the majority of candidates, however, too many candidates are still using a ruler to draw the line graph when a smooth curve was required.
- (ii) Nearly all candidates successfully identified the time interval for the fastest rate of reaction.
- (iii) Most candidates were able to achieve one of two marks for identifying the trend as time increased the volume of gas increased. Fewer candidates achieved the second marking point for indicating no further gas was produced after 50s. Care needs to be taken to ensure units are mentioned when giving numerical values e.g. 50s or volume of gas in cm³.

- (b) (i) Candidates were asked to explain, in terms of particles, why heating acid would increase the rate of a reaction. Most candidates understood that heating the acid would provide the particles with additional kinetic energy allowing them to move faster. Fewer candidates went on to explain that faster moving particles would mean that there would be more successful collisions.
- (ii) Most candidates were able to identify one other way of increasing the rate of this reaction. For those mentioning concentration of acid it was important to note that a more concentrated acid was needed to increase the rate of reaction.
- Q5** (a) As with foundation tier, candidates struggled to provide accurate definitions. In this question the definition of electrolysis was needed. Most candidates were able to achieve one of the two available marks for mentioning that electricity was used or needed in the process.
- (b) Naming the ore of aluminium was very well answered.
- (c) Completing the half equation for the formation of aluminium at the cathode proved to be challenging for many candidates, with only more able candidates successfully answering for full two marks.
- (d) This question was well answered with the majority of candidates able to identify the gas produced at the anode.
- (e) Higher level candidates were able to fully answer this question identifying that the carbon anode wears away because of its reaction with oxygen.
- (f) Candidates found this question challenging and did not focus their answer on the economical aspect of recycling aluminium. Many made reference to the impact on the environment and saving resources rather than saving energy.
- Q6** This was a good question for differentiating between candidates' abilities.
- (a) Most candidates scored at least one mark in this question for saying the crude oil is heated. Very few candidates went on to answer in full and achieve full marks. A number of candidates explained how fossil fuels are formed which was not what the question asked for.
- (b) Generally well answered with most candidates accurately circling 'butene'.
- (c) Most candidates were able to achieve at least two out of the three available marks for this question by correctly drawing the structural formula of ethane and naming butane. The third mark for drawing the structural formula of propene proved more challenging with only the most able candidates answering correctly.
- (d) (i) Polymerisation was very well answered.
- (ii) Very few candidates were able to complete the equation for the formation of PVC. Many realised the double bond needed to be broken but did not form the single bonds either side of the carbon atoms.
- (iii) As with definitions throughout this paper and the foundation paper, many candidates hinted at the answer but did not provide enough detail to achieve the mark.
- (e) Completing the equation allowed many candidates to achieve one or two of the available marks. Many candidates missed out on the third mark as they were not able to balance the equation. A number of candidates recorded their answer as a word equation and could not be awarded any marks.

Assessment Unit 3

Physics

Foundation Tier

Overview

This foundation tier paper was well received by candidates across the ability spectrum. It was very pleasing to see only a few blank spaces across most papers. Even the six mark QWC question was attempted by the majority of candidates; albeit with differing levels of success. Very few questions contained un-attempted responses and the broad range of marks achieved backs up this impression.

- Q1** This question on electric circuits was well received by the majority of candidates. In Part (a) most could correctly draw two of the three symbols for the parts given in the diagram. Some were more successful and could draw all three electric symbols in a complete circuit diagram. The biggest obstacle for most to achieve full marks came with the drawing of the cell / battery. In Part (b) most could connect the components named to the correct given symbol. In Part (c) most realised that a switch being opened caused a gap or break in the circuit or stopped the flow of electric current. In Part (d)(i) most candidates could read the table of information given and deduce that increasing the number of bulbs would reduce the voltage across each bulb. In Part (d)(ii) most knew that increasing the number of bulbs in a series circuit would make the bulbs dimmer due to a decrease in current or voltage. In Part (e) most also knew adding more bulbs into a parallel circuit would have no effect on the voltage across each bulb.
- Q2** This question on space was also well received. In Part (a) most candidates could interpret the Solar System model, with most recognising the Sun, but few recognised the moon, thinking it was another planet. In Part (b) most knew the difference between the rocky and gas planets and so could successfully name a rocky planet in Part (i) and a gas planet in Part (ii). In Part (c) most knew that craters were evidence for asteroids having struck planets in the past. In Part (d)(i) most were able to identify the correct conclusion given in the table of information “as mass increases, gravity increases”. However, in Part (ii) there were a lot of candidates who did not read the question correctly and used the mass of the planet rather than the mass of the astronaut in their calculation of weight and so gained no marks.
- Q3** This question on waves was also well received by the majority of candidates. In Part (a) most recognised that the diagram given showed that the amplitude of the wave stayed the same but the wavelength decreased. In Part (b) most could read the table of information given and state the correct trend in Part (i) while estimating a safe listening time in Part (ii). In Part (c)(i) most knew that vibrations or energy would be transferred as the wave travelled and also knew in Part (ii) that sound was a longitudinal wave. In Part (d) most knew that sounds with a frequency greater than 20kHz are called ultrasound.

- Q4** This question on heat transfer proved to be a discriminator. In Part (a)(i) few candidates knew that radiation was how the heat traveled from the heater to the tube, but most knew, in Part (ii) that convection was how heat moved through the water. In Part (b)(i) most candidates knew one thing that had to be done to ensure a fair test but had difficulty stating a second. In Part (ii) most thought, incorrectly, that black attracts heat when black actually absorbs heat. In Part (iii) very few candidates could state that the reason for working out the temperature rise after three minutes was to give a comparison between the surface colours or because the starting temperatures were different. In Part (iv) most knew that to make the investigation more reliable it should be repeated.
- Q5** In Part (a) most knew either that the burner changed chemical energy to heat in Part (i) or that the generator changed kinetic energy to electrical in Part (ii) but few knew both. In Part (b)(i) too many candidates stated incorrectly that non-renewable meant that a source could not be reused when the correct definition is that they will run out. In Part (ii) most could name a fossil fuel as either coal, oil or gas. In Part (c)(i) a lot of candidates could not work out that the small divisions on the y-axis scale were each worth 2% and so could not carry out the correct subtraction. In Part (ii) most could use the information to work out that the most efficient source would need the least input energy.
- Q6** This question about stopping distance also proved to be a discriminator. In Part (a) (i) most candidates could use the table given to work out the correct braking distance and in Part (ii) state that the vehicle that would stop in the shortest time was the one with the shortest stopping distance. In Part (b)(i) when asked to define thinking distance most candidates incorrectly referred to the time taken rather than the distance travelled by the vehicle before the brakes were applied and so could not gain full marks. In Part (ii) most knew that a shorter reaction time would lead to a decreased thinking distance.
- Q7** In Part (a) most candidates knew that electricity would be produced if either the wheel, magnet or coil of wire was turned and this would make the lamp work and so gained two out of the three marks available. Few could state that in this scenario the magnet must turn inside the coil of wire to produce the electricity. In Part (b) most could state that the current increased as the speed increased but few could go on to explain that over a speed 30km/h the current stayed the same at 520mA.
- Q8** This question about radioactivity proved to be a good discriminator. In Part (a) (i) few candidates could apply their knowledge of radiation penetrating power to a new context and work out that alpha was the best source as it would not escape through the metal and plastic casing so causing no damage to surrounding tissue. Most candidates just stated their knowledge that alpha was stopped by paper, beta by aluminium and gamma by lead. In Part (ii), however, most realised that a long-lasting radioactive source meant that there was no need for repeat operations to implant a new pacemaker. Part (b) was well received with most candidates knowing that background radiation was radiation that is all around us all the time in Part (i) and able to calculate the percentage that medical sources contribute to background radiation in part (ii).
- Q9** This was the six-mark QWC question on the electromagnetic spectrum and it was pleasing to see so few blank spaces. Most candidates were able to state a use and a danger of gamma rays and so gain two marks. Those candidates who achieved four marks could also state either that the two missing waves were ultraviolet (A) and infrared (B), state two similarities or two differences between the waves in the spectrum.

Higher Tier

Overview

This higher tier paper was well received by candidates across the ability spectrum. It was very pleasing to see very few blank spaces across the majority of papers. Even the six mark QWC question was attempted by the vast majority of candidates. It was pleasing to see very few candidates scoring less than ten marks which suggests that most were entered for the correct tier.

- Q1 Q2 Q3 Q4** These were the overlap questions with the foundation tier paper and the comments from GSA31 are appropriate for this paper although each question was a little better received by the higher tier candidates.
- Q5** This question on heat transfer was very well received with most candidates able to state in Part (a)(i) that heat would travel through the copper pipe by conduction. Few could state that this was because copper had free electrons. In Part (ii) most realised that shiny surfaces reflect heat back into the water to reduce heat loss. In Part (b) most candidates could state that as pipe diameter increased, heat loss increased but few could interpret the data to state the second trend successfully (as temperature difference increased, heat loss increased). Part (c) was well received with most candidates knowing in Part (i) that radiation was how heat transferred straight from the fire to the hands and that convection carried the heat up the chimney.
- Q6** This question on waves proved to be a good discriminator. In Part (a) some had difficulty rearranging the formula to calculate distance and so gained no marks. Those that could rearrange the equation normally gained at least two marks. The conversion from meters to kilometers was necessary to gain full marks. In Part (b) most candidates knew that in longitudinal waves the particles moved parallel with the wave travel and in transverse waves the particles moved at right angles to the wave travel, but few stated that the particles vibrate in these directions. In Part (c) those that did not gain full marks usually were unable to work out that the small divisions on the y-axis scale.
- Q7** This question was well received with most candidates recognising the transformer in the diagram was a step-up transformer as the voltage or number of turns had increased on the output side in Part (a)(i). In Part (ii) most candidates could deduce that the transformer was 100% efficient as no power was lost. In Part (iii) most could rearrange the formula to correctly calculate the output current of this transformer. In Part (b)(i) most candidates knew the correct electrical symbol for a variable resistor and in Part (ii) they could state that increasing the wire either increased the resistance or reduced the current. In Part (iii) most knew that variable resistors were used as dimmer switches, oven or volume controllers. In Part (c) most could deduce from the graph that Nickel was the best conductor as it had the least resistance.
- Q8** This question on reducing fossil fuel use in transport proved to be a good discriminator. In Part (a) some candidates knew that an extender was added to a fuel, and some knew that a substitute was a fuel used instead of fossil fuels, but few could describe both. Even fewer could give alcohol as an example of an extender and biodiesel as an example of a substitute. In Part (b) most candidates knew that a hybrid system was powered by both fuel and electricity. In Part (c)(i) most could deduce from the table that as speed increased, fuel economy increased but few recognised that at speeds of more than 40mph the fuel economy decreased. Even fewer could explain why driving hybrid cars could reduce the use of fossil fuels in Part (ii).

Q9 This question on astronomy also proved to be a good discriminator with a lot of vague trends being stated in Part (a)(i). Most could see from the information provided that as time went on, temperature decreased but few could state that as time lapsed, the temperature of the Universe decreased. In Part (ii) few realised that fusion would begin as soon as hydrogen nuclei formed. In Part (b) fewer than half the candidates were aware of the steady state theory. In Part (c) most candidates identified that Galaxy X was furthest away, but few could state that this was due to it having the greatest amount of red-shift or the largest increase in wavelength. In Part (d) most knew that a light-year was the distance light travelled in one year.

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