GCSE EXAMINERS' REPORTS

APPLIED SCIENCE (Double Award)
GCSE

SUMMER 2023

Introduction

Our Principal examiners' reports offer valuable feedback on the recent assessment series. They are written by our Principal Examiners and Principal Moderators after the completion of marking and moderation, and detail how candidates have performed.

This report offers an overall summary of candidates' performance, including the assessment objectives/skills/topics/themes being tested, and highlights the characteristics of successful performance and where performance could be improved. It goes on to look in detail at each question/section of each unit, pinpointing aspects that proved challenging to some candidates and suggesting some reasons as to why that might be.[i]

The information found in this report can provide invaluable insight for practitioners to support their teaching and learning activity. We would also encourage practitioners to share this document – in its entirety or in part – with their learners to help with exam preparation, to understand how to avoid pitfalls and to add to their revision toolbox.

Further support

Document	Description	Link
Professional Learning / CPD	WJEC offers an extensive annual programme of online and face-to-face Professional Learning events. Access interactive feedback, review example candidate responses, gain practical ideas for the classroom and put questions to our dedicated team by registering for one of our events here.	https://www.wjec.co.uk/home/professional-learning/
Past papers	Access the bank of past papers for this qualification, including the most recent assessments. Please note that we do not make past papers available on the public website until 6 months after the examination.	www.wjecservices.co.uk or on the WJEC subject page
Grade boundary information	Grade boundaries are the minimum number of marks needed to achieve each grade. For unitised specifications grade boundaries are expressed on a Uniform Mark Scale (UMS). UMS grade boundaries remain the same every year as the range of UMS mark percentages allocated to a particular grade does not change. UMS grade boundaries are published at overall subject and unit level. For linear specifications, a single grade is awarded for the overall subject, rather than for each unit that contributes towards the overall grade. Grade boundaries are published on results day.	For unitised specifications click here: Results, Grade Boundaries and PRS (wjec.co.uk)

Exam Results Analysis	WJEC provides information to examination centres via the WJEC secure website. This is restricted to centre staff only. Access is granted to centre staff by the Examinations Officer at the centre.	www.wjecservices.co.uk
Classroom Resources	Access our extensive range of FREE classroom resources, including blended learning materials, exam walk-throughs and knowledge organisers to support teaching and learning.	https://resources.wjec.co.uk/
Bank of Professional Learning materials	Access our bank of Professional Learning materials from previous events from our secure website and additional pre-recorded materials available in the public domain.	www.wjecservices.co.uk or on the WJEC subject page.
Become an examiner with WJEC.	We are always looking to recruit new examiners or moderators. These opportunities can provide you with invaluable insight into the assessment process, enhance your skill set, increase your understanding of your subject and inform your teaching.	Become an Examiner | WJEC

Subject Officer's Executive Summary

The changes to the foundation tier papers to make the marks more accessible at the start (the first 25% of marks) had an effect on the means again this year, with large increases in the means seen for units 1 and 3. Changes made were short answers, graph plotting, simple calculations, fill in the gaps from a choice of words etc.

In all units however, there were many comments on the low attempt rate for questions on both tiers, including very low demand questions. It was also surprising to see non-attempted parts within the pre-release section of unit 2.

Quality of written communication continued to be a problem. Some responses were very unclear or contradictory, with candidates unable to express their ideas. Issues with handwriting quality were reported e.g. explaining carbon footprint. There were also many examples of candidates not reading the question carefully. QER questions were generally answered poorly, with all but one QER in the series having a mean within the bottom band.

Candidates coped better with specified practicals than with than less familiar contexts. Risk assessments, variable identification for non-specified practicals and evaluations were a struggle.

Maths skills were variable. Single stage calculations were managed much better than multi-stage calculations, and converting units was problematic. Graph plotting was also noted as an issue.

Recall of knowledge was a problem for many – this has been an issue for a number of years. However, candidates managed better with recall if a choice of answers was given.

Pack B was the most popular task based assessment. However, candidates performed equally across both packs. In the planning section there was still some confusion on variables. Most could write a method, but often repeats and range were missed. Collecting and recording was the best section, however resolution was weak. In the analysis section, graph plotting and calculations were difficult for candidates. Evaluations and risk assessment were the weakest sections.

In the practical, hypothesis writing, risk assessments, and tables of results were generally good. Graph plotting was more variable. It was apparent that instructions in the method were sometimes not read. Identifying the resolution was problematic for a number of candidates. Calculations were answered well (some were very demanding). Analysis of results was better than in previous series. Candidates have a good understanding of practical terms e.g. reproducibility, true value etc. Plans were variable with lack of clarity being an issue sometimes.

Areas for improvement	**Classroom resources**	**Brief description of resource**
Unit 1 - cells	**HTTPS://RESOURCE.DOWNLOAD.WJEC.CO.UK/VTC/2020-21/EL20-21_8-27/1-1-1_THE_CELL_AND_RESPIRATION.PDF** **HTTPS://RESOURCES.WJEC.CO.UK/PAGES/RESOURCESINGLE.ASPX?RIID=4126**	Knowledge organiser Blended learning

Unit 1 – carbon footprint	**HTTPS://RESOURCE.DOWNLOAD.WJEC.CO.UK/VTC/2020-21/EL20-21_8-27/1-2-1_UNDERPINNING_ENERGY_CONCEPTS.PDF** **HTTPS://RESOURCES.WJEC.CO.UK/PAGES/RESOURCESINGLE.ASPX?RIID=4149**	Knowledge organiser Blended learning
Unit 1 – electrical circuits	**HTTPS://RESOURCE.DOWNLOAD.WJEC.CO.UK/VTC/2020-21/EL20-21_8-27/1-2-4_ELECTRIC_CIRCUITS.PDF** **HTTPS://RESOURCES.WJEC.CO.UK/PAGES/RESOURCESINGLE.ASPX?RIID=4136**	Knowledge organiser Blended learning
Unit 1 - breathing	**HTTPS://RESOURCE.DOWNLOAD.WJEC.CO.UK/VTC/2020-21/EL20-21_8-27/1-1-2_OBTAINING_THE_MATERIALS_FOR_RESPIRATION.PDF** **HTTPS://RESOURCES.WJEC.CO.UK/PAGES/RESOURCESINGLE.ASPX?RIID=4029**	Knowledge organiser Blended learning
Unit 2 – indicator species	**HTTPS://RESOURCE.DOWNLOAD.WJEC.CO.UK/VTC/2020-21/EL20-21_8-27/UNIT%202/2-2_PROTECTING_OUR_ENVIRONMENT.PDF** **HTTPS://RESOURCES.WJEC.CO.UK/PAGES/RESOURCESINGLE.ASPX?RIID=4120**	Knowledge organiser Blended learning
Unit 2 – Punnett squares	**HTTPS://RESOURCE.DOWNLOAD.WJEC.CO.UK/VTC/2020-21/EL20-21_8-27/UNIT%202/2-3-1_FACTORS_AFFECTING_HUMAN_HEALTH.PDF** **HTTPS://RESOURCES.WJEC.CO.UK/PAGES/RESOURCESINGLE.ASPX?RIID=4021**	Knowledge organiser Blended learning

Unit 2 - Carbon cycle	HTTPS://RESOURCE.DOWNLOAD.WJEC.CO.UK/VTC/2020-21/EL20-21_8-27/UNIT%202/2-1-3_TRANSFER_AND_RECYCLING_OF_NUTRIENTS.PDF HTTPS://RESOURCES.WJEC.CO.UK/PAGES/RESOURCESINGLE.ASPX?RIID=3854	Knowledge organiser Blended learning
Unit 2 – control of blood glucose	HTTPS://RESOURCE.DOWNLOAD.WJEC.CO.UK/VTC/2020-21/EL20-21_8-27/UNIT%202/2-3-1_FACTORS_AFFECTING_HUMAN_HEALTH.PDF HTTPS://RESOURCES.WJEC.CO.UK/PAGES/RESOURCESINGLE.ASPX?RIID=4021	Knowledge organiser Blended learning
Unit 3 - radioactivity	HTTPS://RESOURCE.DOWNLOAD.WJEC.CO.UK/VTC/2020-21/EL20-21_8-27/UNIT-3/PDF/WJEC/CONTROLLING_NUCLEAR_REACTIONS.PDF HTTPS://RESOURCES.WJEC.CO.UK/PAGES/RESOURCESINGLE.ASPX?RIID=3715	Knowledge organiser Blended learning
Unit 3 - bonding	HTTPS://RESOURCE.DOWNLOAD.WJEC.CO.UK/VTC/2020-21/EL20-21_8-27/UNIT-3/PDF/WJEC/MATERIAL_FOR_A_PURPOSE_PAGE1.PDF HTTPS://RESOURCES.WJEC.CO.UK/PAGES/RESOURCESINGLE.ASPX?RIID=3988	Knowledge organiser Blended learning
Unit 3 - photosynthesis	HTTPS://RESOURCE.DOWNLOAD.WJEC.CO.UK/VTC/2020-21/EL20-21_8-27/UNIT-3/PDF/WJEC/PRODUCING_FOOD.PDF HTTPS://RESOURCES.WJEC.CO.UK/PAGES/RESOURCESINGLE.ASPX?RIID=3729	Knowledge organiser Blended learning
Unit 4 – task based assessment	HTTPS://RESOURCES.WJEC.CO.UK/PAGES/RESOURCESINGLE.ASPX?RIID=3354	Walkthrough of past assessment

APPLIED SCIENCE (DOUBLE AWARD)

GCSE

Summer 2023

UNIT 1 FOUNDATION TIER

Overview of the Unit

This paper was based on the unit 1 content.

Questions allowed candidates to:

- demonstrate and apply their knowledge and understanding of scientific ideas, processes, techniques and procedures;
- analyse, interpret and evaluate scientific information and evidence, including making judgements and reaching conclusions;
- demonstrate their proficiency in substituting numerical values into equations and solving them, calculating a mean, graph plotting and analysis of data in graphical, tabular and diagrammatical forms.

The quality of extended response was assessed in a question about the structures in plant cells.

Several other questions set in a practical context were also included. These were the use of indicators, electric circuits, making crystals and diffusion.

It was disappointing to see the relatively low attempt rate in a number of questions e.g. 5(a) – underline a phrase and 6(b) - complete an equation by circling formulae.

Questions based on recall tend to be less well answered due to candidates' insecure knowledge of subject content e.g. 3b, 4(c)(i) and 6(c).

Questions based on application of knowledge tend to be better answered e.g. 1(b)(ii), and 2(b)(i)&(iii).

Candidates must read questions carefully and follow instructions e.g. 2(b)(iv).

A substantial number of illegible responses were evident.

Comments on individual questions/sections

Q.1 **(a)** The correct compound was selected in about half of instances.

(b) **(i)** Almost all candidates completed the table correctly to earn both marks.

(ii) Most candidates selected at least two correct statements.

(c) **(i)** Most candidates managed to correctly complete one cell of the table. There was no obvious reason which cell would be correct as it varied from candidate to candidate.

(ii) This was very well answered

Q.2 **(a)** Mostly correct answers seen.

(b) **(i)** All the points appeared on the intersection of major grid lines and as a result they were usually plotted correctly. If a mark was lost it was almost entirely due to the quality of the lines joining the points.

(ii) Many correct statements were seen. There needed to be a reference to wind in the answer since 'It' referred to power. So 'It is not constant' is virtually a copy of the question.

(iii) These questions required analysis of the graph and were answered very well.

(iv) Candidates were expected to draw a horizontal line across the grid at a power of 0.6 MW and then to evaluate the suggestion. This was very poorly answered with few marks being awarded. Firstly, the line was often omitted or drawn in the wrong place. Then candidates did not select the appropriate time spans. About 24% of candidates failed to attempt an answer.

(c) About half of candidates made the expected calculation to arrive at the correct answer.

Q.3 **(a)** This question required recall of knowledge about cells but was aided with diagrams of a plant and animal cell plus a partially completed table. The table was completed very well with marks of 2 or 3 being given most of the time.

(b) This QER question also required knowledge but of the functions of the parts of a plant cell that were given in the table. It was poorly answered with marks of 1 or 2 being awarded. There was no pattern in the parts that were selected, they varied from candidate to candidate. Very rarely a top band answer would appear which was pleasing to see. The non-attempt rate was about 22%.

Q.4 **(a)** This was based on recall of facts about the National Grid system. It required selection of words from a box to complete sentences. This was done very well with many candidates earning three or four marks.

(b) This question required candidates to interrogate data in the form of a table about five energy companies. Parts (i) and (ii) were answered correctly by nearly all candidates. Part (iii) required the addition of five numbers and then a division by five. This was less successfully answered with about half of candidates calculating the correct mean. Some candidates used data for other energy sources than coal.

(c) **(i)** It was rare to award a mark. Candidates hear a lot about carbon footprint but hardly any could describe what it means. The non-attempt rate was about 22%.

(ii) Again very rare to give a mark. Basically, candidates did not know where to start or what information to use. The non-attempt rate was about 25%.

Q.5 This question was based on series and parallel circuits including the use of given equations.

(a) This assessed knowledge of the properties of series circuits. Candidates were required to underline words in brackets to complete the sentence. This was well answered with candidates getting more success in part (i) than (ii). Surprising to note that almost 15% of candidates did not attempt to underline anything.

(b) **(i)** This was well answered. Each part required substitution into a given equation. Part I. was more successfully answered than II. probably because there were only two numbers available in part I. In part II. a third number became available, and candidates did not always select the correct pair to multiply.

(ii) About half of candidates obtained the correct answer. Almost 30% of candidates did not attempt the question.

(c) These questions were about a parallel circuit.

(i) This was very well answered with mostly correct identification of the ammeter.

(ii) This was not answered very well. Candidates did not realise that the voltmeter reading was the same as the battery voltage. Also, almost a 28% non-attempt rate.

(iii) This was even less well answered than part (ii). Candidates were unable to determine ammeter readings by comparing them with the reading on one other ammeter. The non-attempt rate was about 28%.

Q.6 **(a)** Risks are generally not described well. This was no exception. The risk must include the action and how the acid gets onto a named body part. This was rarely seen. There was more success with the control measure since candidates usually state wear gloves or goggles.

(b) About half of candidates circled one correct formula, usually H_2O.

(c) This was very poorly answered. Candidates did not demonstrate any knowledge of how to obtain pure crystals. About a 48% non-attempt rate.

(d) Few candidates used the correct data from the Periodic Table to evaluate the correctness of the given relative formula mass. About a 40% non-attempt rate.

Q.7 **(a)** Candidates had very little success in identifying appropriate variables. This was not well answered. Dependent and independent variables were confused, and some controlled variables were stated in too vague terms e.g. the chip.

(b) A minority of candidates identified the concentration of the dye decreased over time, but it was very rare to see anything creditworthy in an explanation.

(c) This was answered very poorly and hardly any marks were awarded. The non-attempt rate was about 32%.

(d) This part was not attempted by about 50% of candidates. The other 50% answered poorly. Their lines were usually incorrect for one of three reasons:

- It did not start at the same point as the given line
- It did not curve below the given line
- It did not flatten at 7 units before 60 minutes.

APPLIED SCIENCE (DOUBLE AWARD)

GCSE

Summer 2023

UNIT 1 HIGHER TIER

Overview of the Unit

This paper was based on the unit 1 content.

Questions allowed candidates to:

- demonstrate and apply their knowledge and understanding of scientific ideas, processes, techniques and procedures;
- analyse, interpret and evaluate scientific information and evidence, including making judgements and reaching conclusions;
- demonstrate their proficiency in substituting numerical values into equations and solving them, and analysis of data in graphical and tabular forms.

The quality of extended response was assessed in a question about inspiration and the bell jar model.

Several other questions set in a practical context were also included. These were the making crystals, diffusion and electric circuits.

It was disappointing to see the relatively low attempt rate in a number of questions e.g. 1(c), 6(b), &(a) and 7(c).

Questions based on recall tend to be less well answered due to candidates' insecure knowledge of subject content e.g. 1(c), 4, 7(a) and &(c).

Questions based on application of knowledge tend to be better answered e.g. 1(b) and 3(a). However, this was not always the case in this paper e.g. 6(a) & (b).

Candidates must read questions carefully and follow instructions e.g. 3(b)&(d) and 4.

Comments on individual questions/sections

Q.1 **(a)** Risks are generally not described well. This was no exception. The risk must include the action and how the acid gets onto a named body part. This was rarely seen. There was more success with the control measure since candidates usually state wear gloves or goggles.

(b) Just over half of candidates circled one correct formula, usually H_2O.

(c) This was very poorly answered. Candidates did not demonstrate any knowledge of how to obtain pure crystals. About a 28% non-attempt rate.

(d) A minority of candidates used the correct data from the Periodic Table to evaluate the correctness of the given relative formula mass. About a 40% non-attempt rate.

Q.2 **(a)** Candidates had limited success in identifying appropriate variables. Dependent and independent variables were confused and some controlled variables were stated in too vague terms e.g. the chip.

(b) A minority of candidates identified the concentration of the dye decreased over time but it was rare to see anything creditworthy in an explanation.

(c) This was answered very poorly and hardly any marks were awarded.

(d) A minimum of candidates drew an acceptable line. Their lines were usually incorrect for one of three reasons:

- It did not start at the same point as the given line
- It did not curve below the given line
- It did not flatten at 7 units before 60 minutes.

Q.3 **(a)** Many candidates came up with creditworthy solutions. They interpreted the graph and substituted into the given equation correctly. Errors were made either by not converting from MW into kW or converting incorrectly. This resulted in the loss of one mark only.

(b) **(i)** Most candidates earned a mark for calculating how many wind turbines with a mean power output of 0.6 MW were required to match the 3600 MW output of a nuclear power station. However, the question included a statement 'in its lifetime' which candidates ignored so did not take into account the fact that wind turbines need to be replaced three times during the lifespan of a nuclear power station.

(ii) Candidates did not answer this part as well as part (i). There was confusion about the number of wind turbines to consider.

(c) **(i)** This required evaluation of the data in the table. It was answered very poorly. Quite often, there were no numerical values or statements such as half or double used. These scored a mark of zero. Candidates should have compared the cost/unit and commissioning costs of the two methods.

(ii) This was answered better than the previous part but still only a minority of candidates earning any marks. It is likely that candidates answered this part from their own knowledge without referring to the table.

(d) A minority of candidates came up with the correct suggestion that the carbon footprint would be greater but not all gave a reason for their answer.

Q.4 This QER question was mostly assessing recall of knowledge about inspiration and also evaluating the effectiveness of modelling this process with a bell jar. It was poorly answered with the mean mark within the lower band range. Descriptions tended to focus on the lungs and ignored the roles of other structures. When other structures were included, their movement was confused e.g. the diaphragm moves up and out. On other occasions candidates described expiration despite the question stating inspiration. Top band answers were seen but these were few and far between.

Q.5 **(a)** Candidates were expected to identify two advantages of using bioplastics instead of polystyrene from the table and then explain each choice. A list of advantages could earn no more than two marks. About half of candidates identified at least one advantage but were not always successful in providing a matching explanation.

(b) Here, a similar rule applied as in the previous part except only one disadvantage was required with an explanation. Again, about half of candidates identified a disadvantage but not always a matching explanation.

(c) This was very poorly answered. It was very rare to award a mark. Candidates did not relate to the fact that bioplastics are produced from plants which absorb carbon dioxide from the atmosphere during photosynthesis as they grow.

Q.6 This question was based on series and parallel circuits including the use of given equations.

(a) This assessed application of knowledge of the properties of series and parallel circuits. It was very poorly answered in all parts. The marking scheme was simplified to give partial credit for qualitative answers, but this did not lead to the awarding of significantly more marks.

(b) This assessed use of the given equations to make two calculations. There was a very slight improvement in the mean mark compared to part (i). About 32% of candidates did not attempt either calculation. In part (i), candidates did not appear to know that the voltage across each parallel branch is the same in a parallel circuit so could not begin to attempt a solution. In part (ii), the marking scheme was extended so candidates did not have to use their answer from part (i) to solve the problem. This made very little difference to the number of marks awarded.

Q.7 **(a)** This assessed recall of knowledge which was not well known. The electrodes were often labelled positive and negative which was not accepted since they were labelled + and -. The terms anode and cathode were very rarely seen. The word molten was usually omitted when labelling aluminium. The non-attempt rate was about 28%.

(b) Completion of the equation was very poor and it was rare to award more than one mark. There is no excuse for not being able to add the symbol for aluminium since the periodic table is provided on the back page. However, there were no attempts to provide it in about 16% of scripts. It was common to see the symbol for oxygen given as O rather than O_2. The balancing mark was unavailable if the formulae were incorrect.

(c) This question assessed recall of knowledge about the processes occurring at each electrode in terms of electrons. It was very poorly answered and about 35% of candidates failed to attempt it. Many of the attempts did not even refer to electrons.

(d) Both parts required recall of knowledge about the benefits of recycling both economically and environmentally. Once again very poorly answered although there was slightly better knowledge of an environmental benefit.

APPLIED SCIENCE (DOUBLE AWARD)

GCSE

Summer 2023

UNIT 2 FOUNDATION TIER

Overview of the Unit

This paper was based on the unit 2 content.

Questions allowed candidates to:

- demonstrate and apply their knowledge and understanding of scientific ideas, processes, techniques and procedures;
- analyse, interpret and evaluate scientific information and evidence, including making judgements and reaching conclusions;
- demonstrate their proficiency in substituting numerical values into equations and solving them, percentages, calculating area and a mean, fractions, and analysis of data in graphical, tabular and diagrammatical forms.

The quality of extended response was assessed in a question about a practical to determine acceleration.

Two other questions set in a practical context were also included. These were using a quadrat and modelling half-life using dice.

Questions 7, 8 and 9 were based on the pre-release material.

It was disappointing to see the relatively low attempt rate in a number of questions especially in those requiring a selection of given choices such as underline a word or phrase, e.g. 2(a)(i), 5(b), and 5(c)(ii).

Unstructured questions based on recall tend to be less well answered due to candidates' insecure knowledge of subject content e.g. 4(a). Recall questions where candidates were given choices, e.g. underline the correct word, select a word from a box or tick boxes, were better answered e.g. 1(a)(d)&(e), 2(a) and 5(b).

Questions based on application of knowledge tend to be better answered but that was not always the case on this paper e.g. 3(a)(ii), 5(a)(i)&(ii) and 6.

Candidates must read questions carefully and follow instructions e.g. 2(b) and 4(b).

A substantial number of illegible responses were evident.

Comments on individual questions/sections

SECTION A

Q.1 This question was about the solar system. A diagram was provided and candidates were required to select words from a box to answer each question. Parts (a), (d) and (e) were correct most of the time. The least well answered was part (b). It is surprising that about 14% of candidates did not attempt part (e) and 10% for (c).

Q.2 **(a)** This was a question requiring recall of the carbon cycle. Parts (i) and (ii) which involved circling the correct word and ticking boxes were well answered. However part (iii) which did not have the structure of the previous parts was poorly answered. Also about 17% of candidates did not attempt this part.

(b) This part required careful reading of the question. In (i), the equation was given, so as long as candidates substituted the correct information from the table then the calculation was straightforward. Over half of candidates did this correctly. In (ii), candidates had to decide how to proceed. No equation was given and they had to realise to multiply by 5 (days of the week). Less than half of candidates managed to arrive at the correct answer.

Q.3 **(a)** These questions were based on the graph.

(i) Mostly correct answers seen. Some candidates misread the scale and gave an answer of 10.5 units.

(ii) Usually, candidates can describe the trend shown by a graph. That was not the case this time. Lots of answers such as it increases, its positive or it goes up were seen. Also about 20% of candidates did not attempt to answer.

(b) This was an unstructured recall question linking the abundance of lichen to the level of pollution. It was poorly answered combined with a 30% not attempted rate.

Q.4 **(a)** This QER question required recall of knowledge of a specified practical. The attempt rate was just over 80%, The mean mark was equivalent to lower band. Candidates were unable to describe the measurements that would be taken and were unclear about what distance was being referred to. The most common reason for credit being given was a statement about repeating the experiment to reduce uncertainty. There is a point about exam technique to be made here. Question 4 occupied a double page spread on facing sides. Part (b) was based on making calculations on given data from this experiment. This basically told the candidates what time measurements to take which could have been included in the account. It is always worth taking a glance at follow up question parts since, quite often, they give a clue to a preceding part.

(b) Both parts involved substitution into given equations in the form required and just over half of candidates made the calculations to arrive at correct answers. The other candidates made errors such as: dividing by 50 cm as given in the equation even though it is clearly not a time; making the wrong choice about which time to use even though they were, helpfully, given in the order to be used; substituting incorrectly.

Q.5 **(a)** This was a genetics question worth 5 marks. The mean mark was 1.7.

(i) The correct genotype was selected in a minority of occasions.

(ii) The completion of the Punnett square was generally poor. Double alleles were seen for the mother and crosses were sometimes inconsistent. It was often difficult to distinguish between an upper-case F and a lower-case f.

(iii) The stated chance was often not a match to the Punnett square that had just been completed.

(iv) This was very poorly answered. Candidates were unable to make a comparison between both crosses.
(b)Candidates were required to select the correct option by underlining their choice. The majority made the correct choice but carrying oxygen to the bacteria was a popular distractor. About 16% did not attempt an answer.
(c)(i) The table was completed correctly on most scripts however sometimes 12 would appear in the last cell.
(ii) The stages appeared in correct positions in about half of responses.

(iii) Less than half of candidates made the correct selection. About 17% of candidates did not attempt to underline any of the options.

Q.6 This question was based on the use of a quadrat and did not assess recall of knowledge. The question was out of 7 and the mean mark was 2.6.

(a) The majority of candidates calculated the mean correctly.

(b) Less than half of candidates were able to calculate the area from the dimensions in the diagram.

(c) A minority of candidates realised that this answer should be the same as the previous one.

(d) A minority of correct answers seen.

(e) Only a few correct answers seen. Lots of answers did not include working and it is not obvious how they were determined.

(f) Very few acceptable improvements were seen. More common answers that did not earn credit were count all the dandelions or make sure you do the calculations correctly.

SECTION B

The pre-release material is available to candidates for a period of time before the exam and it is assumed that its contents would have been discussed with teachers during that time. It is therefore a surprise to discover the non-attempt rates of the different parts that tended to increase throughout this section.

Q.7 **(a)** Answers were expected in standard form but they only had to be copied from figure 2. A minority of correct answers seen. The non-attempt rate was about 15%.

(b) **(i)** Correct answers seen on about half of instances. The non-attempt rate was about 19%.

(ii) A minority of candidates were able to calculate the correct fraction. The non-attempt rate was about 30%.

Q.8 **(a)** The correct conversion from MHz to Hz was seen on few occasions despite the conversion factor being provided. Two marks were still available for incorrect conversions if the rest of the method was correct. The non-attempt rate was about 29%.

(b) **(i)** The question narrowed the choice down to four iodine radioisotopes. Very few candidates made the correct selection and even less could justify it. A group of candidates ignored the instruction and selected a radioisotope other than iodine. The non-attempt rate was about 30%.

(ii) This was very poorly answered with hardly any candidates gaining a mark. The non-attempt rate was about 31%.

(c) A minority of candidates identified R_4 as being lutetium-177. However, few could justify their answer by using the count rate data in figure 6. The non-attempt rate was about 30%.

Q.9 This question was based on the practical in which radioactive decay is modelled using dice.

(a) Hardly any marks were awarded here. Candidates tended to just restate what was written in the question. The non-attempt rate was about 37%.

(b) **(i)** Few correct answers seen. Even then, lines were not always added to the graph so a mark was lost. The obvious method here is to draw a line across from 300 until it hits line 3 then add another line down to the x-axis. Very few of the added lines did this. Other methods of adding lines are acceptable but they require adding two pairs of lines. The non-attempt rate was about 29%.

(ii) This required selecting the correct options and ticking up to three boxes. Just over half of candidates were able to choose successfully. The non-attempt rate dropped to about 13%.

(c) Both parts were answered very poorly. The red cubes were identified as extra dice, electrons, red wooden cubes and even red blood cells. There were only three possible effects on line 1, every point would be higher, lower or stay the same. Answers did not come close to stating any of these. The non-attempt rate was about 43% in part (i) and 48% in part (ii).

APPLIED SCIENCE (DOUBLE AWARD)

GCSE

Summer 2023

UNIT 2 HIGHER TIER

Overview of the Unit

This paper was based on the unit 2 content.

Questions allowed candidates to:

- demonstrate and apply their knowledge and understanding of scientific ideas, processes, techniques and procedures;
- analyse, interpret and evaluate scientific information and evidence, including making judgements and reaching conclusions;
- demonstrate their proficiency in substituting numerical values into equations and solving them, percentages, calculating area and a mean and analysis of data in graphical, tabular and diagrammatical forms.

The quality of extended response was assessed in a question about carbon in the Earth's atmosphere.

Several questions set in a practical context were also included. These were modelling half-life using dice, monitoring pollution using indicator species, using a quadrat and testing for glucose.

Questions 1,2 and 3 were based on the pre-release material. Questions 1 and 2 were common with the FT.

Questions based on recall tend to be less well answered due to candidates' insecure knowledge of subject content e.g. 5(a), 6(b), 7 and 8(b)&(c).

Questions based on application of knowledge tend to be better answered e.g. 1(a), 2(b)(ii) and 5(b).

Candidates must read questions carefully and follow instructions e.g. 1(b)(i) and 5(b).

Comments on individual questions/sections

SECTION A

The pre-release material is available to candidates for a period of time before the exam and it is assumed that its contents would have been discussed with teachers during that time.

Q.1 **(a)** The correct conversion from MHz to Hz was seen in the majority of occasions. Two marks were still available for incorrect conversions if the rest of the method was correct.

(b) **(i)** The question narrowed the choice down to four iodine radioisotopes. Very few candidates made the correct selection and even less could justify it. A small group of candidates ignored the instruction and selected a radioisotope other than iodine.

(ii) This was very poorly answered with few candidates gaining a mark.

(c) About half of candidates identified R_4 as being lutetium-177. However, fewer could justify their answer by using the count rate data in figure 6.

Q.2 This question was based on the practical in which radioactive decay is modelled using dice.

(a) Few marks were awarded here. Candidates tended to just restate what was written in the question.

(b) **(i)** The correct answer was seen in just under half of scripts. Even then, lines were not always added to the graph so a mark was lost. The obvious method here is to draw a line across from 300 until it hits line 3 then add another line down to the x-axis. Very few of the added lines did this. Other methods of adding lines are acceptable but they require adding two pairs of lines.

(ii) This required selecting the correct options and ticking up to three boxes and most candidates were able to choose successfully.

(c) Both parts were answered very poorly. There were only three possible effects on line 1, every point would be higher, lower or stay the same. Answers did not come close to stating any of these. The non-attempt rate was about 20% in part (i) and 22% in part (ii).

Q.3 **(a)** Answers were expected in standard form and values only had to be copied from figure 2. A minority of correct answers seen.

(b) About half of candidates were able to calculate the correct percentage.

SECTION B

Q.4 **(a)** About 20% of candidates scored full marks for plotting the graph. Others made scale errors, plotting errors and drawing an unacceptable line.

(b) Few answers worth both marks were seen because the increase was not qualified.

(c) A minority of candidates earned more than a mark.

Q.5 **(a)** This was a question requiring recall of the carbon cycle. It required knowledge of natural processes that added and removed carbon dioxide from the atmosphere over thousands of years. This did not include the more recent human additions. The final part of the answer should have explained how these processes stabilised conditions for life on Earth. Lack of human contributions was an acceptable point to make here. The low mean mark demonstrates that, at best, most answers were of lower band quality. Probably the most common statement that earned some credit was referring to trees absorbing carbon dioxide during photosynthesis. Not much else in the indicative content was seen other than in very few responses.

(b) This part required careful reading of the question. It was for candidates to decide how to proceed. No equations were given and candidates had to realise to multiply by 10 (the number of journeys in a working week). About half of candidates managed to arrive at the correct answer. A variety of acceptable methods were used. Errors made by unsuccessful candidates included using data that did not add up to 30km, using figures for buses, not multiplying by 10 and multiplying by 5 due to ignoring the 'each way' instruction.

Q.6 **(a)** This question part was based on the use of a quadrat and did not assess recall of knowledge.

(i) About 25% of candidates calculated the number of dandelions correctly. Others made errors in not determining a mean or incorrectly calculating it and incorrectly calculating the area. Lots of incorrect answers were not accompanied by any working and it was not obvious how some of these answers were arrived at.

(ii) More often than not, solutions involved an ecf. As a result, and because the equation was given to candidates, this part was more successfully answered than the previous part.

(b) This question required recall of information about natural selection. It was not answered well. The term mutation was rarely seen neither were the consequences of the mutation explained. Many answers just repeated what was given in the question. The non-attempt rate was about 17%.

Q.7 All question parts required recall of knowledge which was not well known. As a result the mean marks were all low, particularly in parts (a) and (c).

(a) Typical answers described insulin being used to control blood glucose levels which was just a repeat of the question. In the vast majority of instances there was no mention of the pancreas, glycogen or the liver. On very rare occasions a perfect answer earning full credit would appear. The non-attempt rate was about 18%.

(b) The differences between type 1 and 2 diabetes were better known but still only by a minority of candidates.

(a) The chemical test for glucose was not well known. The non-attempt rate was about 31%.

Q.8 **(a)** This was a genetics question. The mean mark was less than half marks. The correct genotypes were selected in a minority of occasions. The completion of the Punnett squares was generally poor. Double alleles were sometimes seen for the parents and crosses were occasionally inconsistent. It was often difficult to distinguish between an upper-case F and a lower-case f. The stated chances were often not a match to the Punnett squares that had just been completed.

(b) This was a question about the body's defence mechanisms against infection. It required recall of knowledge which was not well known. Most responses did not refer to white blood cells and their role in combating bacteria. The non-attempt rate was about 20%.

(c) This question tested knowledge of short and long-term effects on exercise on the lungs. It also required recall of knowledge and again this was not well known. Where credit was given it was usually for stating the breathing rate increases during exercise. The non-attempt rate was about 17%.

(d) Both parts of this question did not assess recall. The mean marks were higher than in (b) and (c).

(i) Credit was given for calculating A and B in about half of instances. There was often incorrect rounding when working out C. Many of the candidates who completed the calculations did not go on to make a comparative statement.

(ii) A majority of candidates earned both marks for making an accurate comparison. Others compared data which was not asked in the question.

APPLIED SCIENCE (DOUBLE AWARD)

GCSE

Summer 2023

UNIT 3 FOUNDATION TIER

Overview of the Unit

This paper was based on the unit 3 content.

Questions allowed students to:

- demonstrate and apply their knowledge and understanding of scientific ideas, processes, techniques and procedures;
- analyse, interpret and evaluate scientific information and evidence, including making judgements and reaching conclusions;
- demonstrate their proficiency in substituting numerical values into equations and solving them, graph plotting and analysis of data in graphical, tabular and diagrammatical forms.

The quality of extended response was assessed in a question about food storage.

Several questions set in a practical context were also included. These were how light intensity affects the rate of photosynthesis, chromatography, chemical testing and rate of reaction.

It was disappointing to see the relatively low attempt rate in a number of questions e.g. 1(b)(i) – circle an improvement and 3(a)(i) - complete an equation.

Questions based on recall tend to be less well answered due to candidates' insecure knowledge of subject content e.g. 3b, 5(b) & (c) and 6(a).

Questions based on application of knowledge tend to be better answered e.g. 3(c)(ii), 4(b)(i) 5(a)(ii) and 7(c). However, some candidates are losing marks for failure to show their workings.

Candidates must read questions carefully and follow instructions e.g. 4(a) and 5(a)(i).

A substantial number of illegible responses were evident.

Comments on individual questions/sections

Q.1 This question was about photosynthesis.

(a) **(i)** This was a recall question in which candidates had to complete sentences using words from a box. Few candidates did not gain a mark.

(ii) This was also a recall question involving underlining one word in brackets. About half of candidates chose the correct word.

(b) **(i)** Candidates were asked to select the appropriate improvement to some of the steps in the method. About a third of the entry did not attempt the question. However, it was very well done by those that did with most earning 2 or 3 marks.

(ii) Very few correct answers seen. A common response referred to moving the lamp which is the same as step 6 which they were asked to change.

Q.2 **(a)** **(i)** Lots of errors were made when interpreting the chromatogram resulting in many responses earning a mark of zero.

(ii) This calculation was quite well answered. The majority of candidates extracted the correct data from the chromatogram, substituted into the given equation correctly to obtain the correct answer.

(b) All the questions required recall and were poorly answered except part (iii).

(i) About a third of candidates selected the correct compound.

(ii) **I**. Few candidates knew that this compound must be the carbonate.
II. Few candidates could name the gas.

(iii) **I**. A minority of candidates could identify the compound from the result of a precipitate reaction.
II. The majority of candidates were able to complete the Risk with an appropriate action. Most candidates identified that the Control Measure required was to wear goggles.

Q.3 **(a)** **(i)** Candidates were required to complete a nuclear reaction equation. Just over a third did not attempt to. Most of the remainder did not consider the three neutrons on the right-hand side of the equation. As a result, the mass number was usually incorrect.

(ii) About half of candidates correctly circled the moderator.

(iii) Very few candidates deduced from the equation that 3 neutrons are produced in the fission reaction.

(b) **(i)** Knowledge of control rods was very poor. There was confusion with the role of the moderator. Some answers hinted at their role but were too vague.

(ii) The consequences of control rods not being able to move was not well known. Answers tended to focus on damage.

(c) **(i)** Only a minority of candidates earned both of the available marks. A slightly larger group didn't realise that both answer in parts I. and II. should be the same, so even if the answer in I. was correct, a different value was given in part II. The remainder failed to interpret the graph to find the time to decay by a half.

(ii) The half-life table was very structured which allowed most candidates to earn both marks for its completion.

Q.4 **(a)** This QER question required recall of knowledge. It was pleasing to see a high attempt rate (about 90%). The mean mark is equivalent to middle band. Very few candidates failed to earn any credit and some attained top band marks. In some cases, the statement '**other than heating'** was either ignored or not read so answers included methods of heating food. Some methods of food storage were more well-known than others, e.g. refrigeration and freezing.

(b) **(i)** Most candidates earned at least 1 mark for completing the table and the majority scored 2 marks. They interacted well with the diagrams to determine the values to insert into the spaces. Some candidates found difficulty in calculating or using the scaling up factor of 400. It was good practice to use the space for working.

(ii) Few candidates earned any marks in this part. It followed on from (i) in which information about UHT milk was given indicating no bacteria were present. This fact was not used in answers.

Q.5 **(a)** **(i)** About a quarter of candidates earned full marks for plotting the graph and drawing a smooth curve. Others made plotting errors, joined the points with a series of straight lines and some even plotted the points by reading time values on the volume scale and vice versa.

(ii) **I.** Most candidates gained 1 mark but less went on to state the volume reaches a constant value. Some described the shape of the curve without referring to volume or time and these did not get a mark.

II. & III. More candidates gained the mark for I. than II. When answering what time did the reaction stop some gave the volume rather than the time.

(b)& (c) These were all recall marks and were not answered well, particularly parts (b)(ii) and (c)(ii). The attempt rate varied from 70% to 76%.

Q.6 **(a)** Another recall question that had a low mean mark. The difference between ionic and covalent bonding was not well known. Just over 33% of candidates failed to attempt the question.

(b) **(i)** About a quarter of candidates were able complete the diagram to show the transfer of electrons. The question asked for arrows so lines without arrowheads were not accepted.

(ii) Correct answers were seen in a minimum of instances.

Q.7 **(a)** Candidates were required to interact with two tables of information, firstly to identify the materials used in manufacture in 1920, 1950 and 1970, and then to extract data about density and strength. Many answers omitted to refer to 1950 even though it should have been included since the question asked for changes between 1920 and 1970. Most candidates gained at least a mark but a minority earned over half marks. Just stating data from table 2 did not get credit. Also densities can't be added, for example, to give a combined density.

(b) About half of candidates interpreted the data to give acceptable answers. It was surprising how many candidates referred to melting point in part (ii).

(c) No recall of knowledge was required in parts (i) and (ii) so the mean mark was higher. However, about 20% of candidates did not attempt part (i) and 25% for part (ii). It is important to stress that workings should be shown in the allocated space. Wrong answers without working earn a mark of zero.

(i) About half the answers seen earned full marks. A common error was adding the densities of glass and resin and then substituting that value into the given equation.

(ii) **I.** The most common errors here were either converting incorrectly or not attempting any conversion at all.

II. An ecf was allowed here from the previous answer. Correct answers were seen in about half of scripts. Calculation errors were made in others.

APPLIED SCIENCE (DOUBLE AWARD)

GCSE

Summer 2023

UNIT 3 HIGHER TIER

Overview of the Unit

This paper was based on the unit 3 content.

Questions allowed candidates to:

- demonstrate and apply their knowledge and understanding of scientific ideas, processes, techniques and procedures;
- analyse, interpret and evaluate scientific information and evidence, including making judgements and reaching conclusions;
- demonstrate their proficiency in substituting numerical values into equations and solving them and analysis of data in graphical, tabular and diagrammatical forms.

The quality of extended response was assessed in a question about investigating limiting factors.

Several other questions were set in a practical context. These were chromatography, chemical testing and rate of reaction.

It was disappointing to see the relatively low attempt rate in a number of recall questions e.g. 5(a)(iii), 6(a)(ii) and 7(b)(ii).

Questions based on recall tend to be less well answered due to candidates' insecure knowledge of subject content e.g. 4a, 5(a)(iii) and 5(b).

Questions based on application of knowledge tend to be better answered e.g. 2(c)(ii), 4(c)(i) and 5(a)(i).

Candidates must read questions carefully and follow instructions e.g. 4(c)(i), 5(a)(i) and 7(a)(i).

Comments on individual questions/sections

Q.1 **(a)** This was a recall question in which about half of candidates earned both marks.

(b) **(i)** About a half of candidates were able complete the diagram to show the transfer of electrons. The question asked for arrows so lines without arrowheads were not accepted.

(ii) Correct answers were seen in about half of instances.

Q.2 **(a)** Candidates were required to interact with two tables of information, firstly to identify the materials used in manufacture in 1920, 1950 and 1970, and then to extract data about density and strength. Some answers omitted to refer to 1950 even though it should have been included since the question asked for changes between 1920 and 1970. Most candidates gained at least a mark and about half earned 2 or more marks. Just stating data from table 2 did not get credit.

(b) Over half of candidates interpreted the data to give acceptable answers.

(c) No recall of knowledge was required in parts (i) and (ii) so the mean mark was higher. It is important to stress that workings should be shown in the allocated space. Wrong answers without working earn a mark of zero.

(i) Most of the answers seen earned full marks.

(ii) **I.** The most common errors here were either converting incorrectly or not attempting any conversion at all.

II. An ecf was allowed here from the previous answer. Correct answers were seen in most scripts. Calculation errors were made in others.

Q.3 This question was about photosynthesis.

(a) **(i)** This was a recall question in which candidates had to describe photosynthesis and also explain why Ash dieback disease affects growth of trees. About half of candidates earned 3 or 4 marks for their accounts. Marks were lost for the omission of facts about photosynthesis and being unable to explain the impact of dieback disease.

(b) The details of this investigation into limiting factors were not well known. Typically, candidates described the effect of light intensity and ignored temperature and carbon dioxide concentration. Other theoretical answers were seen which did not contain any experimental details. The mean mark is equivalent to bottom band.

Q.4 **(a)** Both parts of this question required recall of knowledge. The mean marks were low.

(i) Knowledge of the graphite moderator was poor. There was confusion with the role of control rods.

(ii) The consequences of control rods not being able to move was not well known. Answers tended to focus on damage or cause a meltdown.

(b) Candidates were required to complete a nuclear reaction equation. Most did not consider the single neutron on the left-hand side of the equation. As a result, the mass number of Kr was usually incorrect. It was surprising that the three circles on the extreme right of the diagram were not recognised as neutrons.

(c) **(i)** The majority of candidates did as instructed and added lines to the graph to determine the half-life. Those that failed to add lines lost a mark even if the half-life was correct.

(ii) This was very poorly answered with very few correct answers seen. Most candidates did not know what to do with the fraction 1/32.

Q.5 **(a)** **(i)** This calculation was well answered. The majority of candidates extracted the correct data from the chromatogram, substituted into the given equation correctly and rearranged to obtain the correct answer. However, some failed to add to the diagram.

(ii) his was quite well answered with over half of candidates gaining both marks.

(iii) This recall question was very poorly answered. There was little apparent knowledge of mobile and stationary phases. About 20% of candidates failed to attempt the question.

(b) The question parts required recall and were poorly answered.

Q.6 **(a)** **(i)** Under half of candidates earned both marks. Usually answers did not refer to the heating process.

(ii) This recall question was very poorly answered. There was little apparent knowledge of homogenisation. Over 20% of candidates failed to attempt the question.

(b) **(i)** Just over half of candidates completed the table with the correct value. They interacted well with the diagram to count the colonies and then determine the value to insert into the space. Some candidates found difficulty in calculating or using the scaling up factor of 400. It was good practice to use the space for working.

(ii) A minority of candidates earned any marks in this part. It followed on from (i) in which information about UHT milk was given indicating no bacteria were present. This fact was not always used in answers.

Q.7 **(a)** **(i)** The correct answer was only seen in a small minority of cases. The instruction to give the answer to 2 significant figures was often ignored. Sometimes the expected numerator and denominator were inverted.

(ii) About a third of candidates spotted the pattern in the results table to give an acceptable answer.

(b) **(i)** Most candidates earned some credit for their answers but few achieved full marks. Particle theory of reactions was not well known.

(ii) This was very poorly answered. About 20% of candidates failed to attempt it. There was little idea of a reaction being limited by the reactant not in excess.

APPLIED SCIENCE (DOUBLE AWARD)

GCSE

Summer 2023

UNIT 4 FOUNDATION TIER

Overview of the Unit

- All AOs are assessed in this Unit.
- Both packs tested candidates' ability to: plan; carry out experiments; make measurements and record them; analyse data; evaluate methods and data; and to assess risk.
- Pack A tested candidates' ability within the topics of: Exercise and fitness in humans; Materials for a purpose; and Our planet.
- Pack B tested candidates' ability within the topics of: Our place in the Universe; Materials for a purpose; and Obtaining the materials for respiration.
- Pack B was much more popular than Pack A.
- Candidates appeared to generally perform equally well across both packs.
- Candidates' ability to answer questions fully continues to improve, and many fewer candidates were leaving questions blank.
- It was obvious that some centres had practiced assessments on this Unit with their candidates, whilst other did not.

Comments on individual questions/sections

Activity 1

Task A Planning

- Some candidates are still confused by the terms: independent; dependent and controlled variables.
- On average, candidates scored over 50% on this section.
- Most candidates were able to identify some of the variables, although those candidates doing Pack A, found it more of a challenge to describe the rate/time component of the pulse.
- It was good to see most candidates doing Pack A describing their hypothesis.
- Many candidates doing Pack B failed to draw a labelled diagram of the apparatus, and effectively only drew a list of apparatus, without showing how they integrated together.
- Most candidates attempted to write a method, and the quality of candidates' SPaG continues to improve, with many candidates obviously going back over their method and correcting spelling and punctuation.
- Candidates do need to be able to spell key scientific words correctly. These are generally words that can be found in the introduction to the Activity.
- Centres do need to remind their candidates to check that their methods include repeats and the correct range for the experiment, as requested in the Task instructions.

Task B Collecting and recording

- This section continues to be the highest scoring section, with candidates, on average, scoring over 75% of the marks available.
- Many candidates failed to write the resolution of their stopwatch (Pack A) or ruler (Pack B).
- The vast majority of candidates managed to take repeated readings across the stated range, with many obviously taking care to ensure that their repeats were similar to each other.
- Some candidates still need practice with listing units on tables and using the correct (consistent) number of decimal places on columns of numbers, particularly when calculating means.
- A significant minority of tables were very scrappy. Centres need to practice this with their candidates. Please encourage candidates to use the space to record their rough data and then produce a good quality 'best' table in the space at the bottom of the page.

Task C Analysis

- As with the planning section, candidates, on average, scored just over 50% of the available marks for this section. The common difficulties involved plotting the graph/chart, and performing calculations.
- Candidates do need to be more critical of their data, and check for obvious anomalies. These should be identified and removed from any mean calculations.
- Candidates should practice calculating mean values of repeated measurements and expressing them to the same number of decimal points as the (primary) data.
- Candidates still find it very challenging to produce accurate graphs/charts. Common mistakes involve: non-linear scales; inaccurate point plotting; and poor best-fit line drawing (if appropriate). Centres should continue to give candidates lots of practice on this skill.
- It is pleasing to see that most candidates are able to describe the pattern in their results.
- Candidates found the calculations quite challenging. In Pack A, many candidates did not know how to calculate a percentage change, and in Pack B, many had difficulties substituting the numbers into the two, given equations. The majority of candidates did not correctly round numerical answers up or down to the correct number of decimal places. This requires continual practice throughout the course.

Task D Evaluation

- As continues to be the pattern, candidates find the evaluation component of any task, hardest, and on average, candidates only scored about 30% of the available marks.
- When asked about the suitability of the experiment, many candidates write about the own performance during the experiment, or state that the method was easy to follow. Candidates need to either examine the pattern in the data, or give a comment about the uncertainty of the data.
- Candidates need to be more aware of the difference between repeatability and reliability, as when asked if their results are repeatable, many candidates answer using the word 'reliable'. Candidates also need to distinguish between their results for different independent variable values, and the similarity of repeated values.
- Candidates are better at spotting inaccuracies and suggesting improvements, although extensions to an investigation are not considered to be improvements.
- Many candidates find explaining the suggestion/agreement question at the end of this section a challenge. Candidates should take more time reading this question, and thinking about a suitable response, before writing their final answer. There is no credit for a simple Yes/No answer, an explanation is needed.

Activity 2

Task A Analysis

- Candidates scored higher on the Activity 2 Analysis than they did on the Activity 1 Analysis section.
- Most candidates were unable to determine the cross-sectional area of the rubber band, and a significant minority of candidates doing Pack A failed to calculate the distance travelled by the waves correctly.
- Most candidates were able to identify the anomalous result in the data set, but many did not remove the value from their calculation of the mean, and many did not round their calculated values correctly.
- Most were able to state the pattern in their data.
- Most candidates found the calculations challenging, particularly with rounding. Centres do need to practice this with their candidates.
- Candidates are quite good at extracting information from text or from tables, but then find applying that information more difficult.

Task B Evaluation

- As has been the case historically, candidates find evaluations very challenging.
- Candidates scored higher on the Activity 2 Evaluation than they did on the Activity 1 Evaluation section.
- When asked about the suitability of the experiment, many candidates write about the method being easy to follow. Candidates need to either examine the pattern in the data, or give a comment about the uncertainty of the data.
- Candidates found it quite hard to explain why each measurement was repeated three times. Many talked about 'reliability', although most that gained credit, mentioned the need to calculate a mean value. Very few wrote about spotting anomalies or reducing uncertainty.
- A significant minority were able to get credit for the questions specific to Pack A or Pack B, although most failed to gain full credit. These questions are generally about reducing uncertainty.
- Most candidates did not get any credit for the final question in this section for both packs. Most will state whether they agree or not, but few will give a creditable explanation.

Activity 3

- Candidates still find constructing a risk assessment difficult. Although candidates score better than on evaluation sections, candidates, on average, only gain 40% of the mark for the Risk Assessment activity.
- Centres are reminded to run through the general structure of a CLEAPSS Student Safety Sheet, as many of the expected responses are contained within each one.
- Please ensure that candidates know that:
    - Hazards require the specific nature of the hazard to be stated (e.g. Pressed castor oil is toxic; Amylase powder is an irritant) – the specific nature is lifted straight off the Student Safety Sheet.

- Risks must have an injury and an action (e.g. burning paraffin could burn hair/skin/eyes during heating; hot water could scald the skin if touched during heating). A significant minority correctly identified the relevant injuries, but did not stated the action. Please keep candidates aware that some identified Hazards, are in fact, low hazards, and as such the is 'No specific risk' and 'No specific control measures'. Risks must be related to the hazard.
- Control measures need to appropriate for the stated Hazard and Risk. When handling hot apparatus, gloves need to be stated as heat-proof. Some control measures are specified on the relevant Student Safety Sheet. (e.g only handle in a fume cupboard or a well-ventilated room).

APPLIED SCIENCE (DOUBLE AWARD)

GCSE

Summer 2023

UNIT 4 HIGHER TIER

Overview of the Unit

- All AOs are assessed in this Unit.
- Both packs tested candidates' ability to: plan; carry out experiments; make measurements and record them; analyse data; evaluate methods and data; and to assess risk.
- Pack A tested candidates' ability within the topics of: Exercise and fitness in humans; Materials for a purpose; and Our planet.
- Pack B tested candidates' ability within the topics of: Our place in the Universe; Materials for a purpose; and Obtaining the materials for respiration.
- Pack B was much more popular than Pack A.
- Candidates appeared to generally perform equally well across both packs.
- Candidates' ability to answer questions fully continues to improve, and many fewer candidates were leaving questions blank.
- It was obvious that some centres had practiced assessments on this Unit with their candidates, whilst other did not.

Comments on individual questions/sections

Activity 1
Task A Planning

- Some candidates are still confused by the terms: independent; dependent and controlled variables; and despite the fact that candidates are reminded to describe the variables, a significant minority fail to do this. Candidates doing Pack A, found it more of a challenge to describe the rate/time component of the pulse.
- On average, candidates scored over 60% on this section.
- It was good to see most candidates doing Pack A, describing their hypothesis.
- Many candidates doing Pack B failed to draw a labelled diagram of the apparatus, and effectively only drew a list of apparatus, without showing how they integrated together.
- Most candidates attempted to write a method, and the quality of candidates' SPaG continues to improve, with many candidates obviously going back over their method and correcting spelling and punctuation.
- Candidates do need to be able to spell key scientific words correctly. These are generally words that can be found in the introduction to the activity.
- Centres do need to remind their candidates to check that their methods include repeats and the correct range for the experiment, as requested in the Task instructions.

Task B Collecting and recording

- This section continues to be the highest scoring section, with candidates, on average, scoring over 85% of the marks available.

- Many candidates failed to write the resolution of their stopwatch (Pack A) or ruler (Pack B).
- The vast majority of candidates managed to take repeated readings across the stated range, with many obviously taking care to ensure that their repeats were similar to each other.
- Some candidates still need practice with listing units on tables and using the correct (consistent) number of decimal places on columns of numbers, particularly when calculating means.
- A significant minority of tables were very scrappy. Please encourage candidates to use the space to record their rough data and then produce a good quality 'best' table in the space at the bottom of the page.

Task C Analysis

- As with the Planning section, candidates, on average, scored just under 60% of the available marks for this section. The common difficulties involved plotting the graph/chart, and performing calculations.
- Candidates do need to be more critical of their data, and check for obvious anomalies. These should be identified and removed from any mean calculations.
- Candidates should practice calculating mean values of repeated measurements and expressing them to the same number of decimal points as the (primary) data.
- Candidates still find it very challenging to produce accurate graphs/charts. Common mistakes involve: non-linear scales; inaccurate point plotting; and poor best-fit line drawing (if appropriate). Centres should continue to give candidates lots of practice on this skill.
- It is pleasing to see that most candidates are able to describe the pattern in their results.
- Candidates found the calculations quite challenging. In Pack A, many candidates did not know how to calculate a percentage change, and in Pack B, many had difficulties substituting the numbers into the two, given equations. The majority of candidates did not correctly round numerical answers up or down to the correct number of decimal places. This requires continual practice throughout the course.

Task D Evaluation

- As continues to be the pattern, candidates find the evaluation component of any task, hardest, and on average, candidates scored just over 40% of the available marks.
- When asked about the suitability of the experiment, many candidates write about the own performance during the experiment, or state that the method was easy to follow. Candidates need to either examine the pattern in the data, or give a comment about the uncertainty of the data.
- Candidates need to be more aware of the difference between repeatability and reliability, as when asked if their results are repeatable, many candidates answer using the word 'reliable'. Candidates also need to distinguish between their results for different independent variable values, and the similarity of repeated values.
- Candidates are better at spotting inaccuracies and suggesting improvements, although extensions to an investigation are not considered to be improvements.
- Many candidates find explaining the suggestion/agreement question at the end of this section a challenge. Candidates should take more time reading this question, and thinking about a suitable response, before writing their final answer. There is no credit for a simple Yes/No answer, an explanation is needed.

Activity 2

Task A Analysis

- Candidates scored significantly lower on the Activity 2 Analysis than they did on the Activity 1 Analysis section.
- Most candidates were able to identify the correct oils for Pack B.
- Most candidates were able to identify the anomalous result in the data set, but many did not remove the value from their calculation of the mean, and many did not round their calculated values correctly.
- Most were able to state the pattern in the data for Pack A, but candidates in Pack B found this harder.
- Most candidates found the calculations challenging, particularly with rounding. A significant minority of candidates doing Pack B found it difficult determining the drip speed from the graph and data supplied.
- Candidates are quite good at extracting information from text or from tables, but then find applying that information more difficult.

Task B Evaluation

- As has been the case historically, candidates find evaluations very challenging.
- Candidates scored slightly higher on the Activity 2 Evaluation than they did on the Activity 1 Evaluation section.
- When asked about the suitability of the experiment, many candidates write about the method being easy to follow. Candidates need to either examine the pattern in the data, or give a comment about the uncertainty of the data.
- Candidates found it quite hard to explain why each measurement was repeated three times. Many talked about 'reliability', although most that gained credit, mentioned the need to calculate a mean value. Very few wrote about spotting anomalies or reducing uncertainty.
- A significant minority were able to get credit for the questions specific to Pack A or Pack B, although most failed to gain full credit. These questions are generally about reducing uncertainty.
- Most candidates did not get any credit for the final question in this section for both packs. Most will state whether they agree or not, but few will give a creditable explanation.

Activity 3

- Candidates still find constructing a risk assessment difficult. Although candidates score better than on evaluation sections, candidates, on average, only gain 40% of the mark for the Risk Assessment activity.
- Centres are reminded to run through the general structure of a CLEAPSS Student Safety Sheet, as many of the expected responses are contained within each one.
- Please ensure that candidates know that:
    - Hazards require the specific nature of the hazard to be stated (e.g. Pressed castor oil is toxic; Amylase powder is an irritant) – the specific nature is lifted straight off the Student Safety Sheet.
    - Risks must have an injury and an action (e.g. burning paraffin could burn hair/skin/eyes during heating; hot water could scald the skin if touched during heating). A significant minority correctly identified the relevant injuries but did not stated the action. Please keep candidates aware that some identified Hazards, are in fact, low hazards, and as such the is 'No specific risk' and 'No specific control measures'. Risks must be related to the hazard.
    - Control measures need to appropriate for the stated Hazard and Risk. When handling hot apparatus, gloves need to be stated as heat-proof. Some control measures are specified on the relevant Student Safety Sheet. (e.g. only handle in a fume cupboard or a well-ventilated room).

SCIENCE PRACTICAL ASSESSMENT

GCSE

Summer 2023

Overview of the Unit

In this unit candidates are assessed on their practical skills including, forming hypothesises, recognising and preventing hazards and risks, recording and presenting data, understanding the variables that are involved in experiments, evaluating the success of the experiment and planning improvements.

The tasks all proved to be accessible for most candidates who usually attempted all sections of the tasks. Certain tasks proved more popular than others within the suite, in particular the resistance of the wire practical probably due to the familiarity with the experiment itself.

Comments on individual questions/sections

Section A - Hypotheses and risk assessments

Most candidates were able to make a sensible hypothesis in each of the 9 tasks, which linked the independent and dependent variables. In producing risk assessments, the most successful candidates linked the risk with a particular action in the method, such as spilling chemicals onto skin whilst pouring, and were able to suggest a sensible control measure for that risk. Less successful candidates often did not link the risk to an action or referred to chemicals splashing into eyes which could not be credited. In the springs task and in the yeast task it was rare to see no significant risk as a response and many spurious risks were seen.

Section A - Tables of results

Most candidates produced well organised tables of results and recorded all their data. It was pleasing to see that most candidates included units in the table headings and not in the body of the table. Although not commonplace, incorrect units or use of incorrect abbreviations of units (e.g. secs for s / seconds) were seen. In some cases, headings lacked detail and could not be credited. In the sodium thiosulfate task, many candidates simply had the heading concentration and did not refer to sodium thiosulfate. This was required to distinguish between this and hydrochloric acid. There was evidence that candidates often do not read the instructions provided, for example in the springs task candidates were instructed to record the length at 0 g which many failed to do. Where required, means were generally calculated correctly. In the spring task, some candidates calculated and recorded extensions which was not required of them.

Section B – Variables

Each of the 9 tasks included a section on variables. Candidates were able to identify the independent and dependent variables across all the tasks and most were able to state the range of these variables. Less successful candidates simply listed all the values of the variable when asked for a range, but this was seen less often than in previous series. One area for development that was noted was the resolution of the instruments used. Where this was asked it was common to see incorrect values given. Many of the tasks explored either how or why certain variables were controlled, and this was less well-answered than other areas of the section on variables.

For example, in the sodium thiosulfate task, candidates were required to explain how the volume of the sodium thiosulfate was controlled but most candidates didn't state either the volume of the of the solution used or the instrument used to measure this volume. In the resistance in a wire task, candidates were asked to explain why the thickness of the wire was controlled. This was poorly answered with most candidates not linking a change in thickness with a change in resistance and current.

Section B – Graphs

Graphs continue to produce a mixture of results with the same errors consistently appearing:

- Axes labels missing or without units or with incorrect units (see tables above);
- Less than half the graph paper area being used for scales, the origin left blank, using scales with multiples of 3 or 7, (this was not enforced for the x-axis in the resistance of the wire practical).
- Line of best fit was varied in standard with thick or wispy lines common place.

The subsequent description of the graphs was generally well answered when a basic description of the relationship between independent and dependent variables was required. However, when a second mark was sought for a more detailed description of the curve many candidates found this more difficult and often did not attempt to do so.

Section B - Calculations

Across all the tasks, where candidates were asked to use equations, calculations were answered well by most candidates, this included calculations of spring constants, resistance, power, RQ values, heat energy released and uncertainty.

Section B – Analysis and evaluation of results

Compared to previous series, it was far more common to see candidates describing their data in detail. In the resistance in a wire task, many were able to describe the current decreasing at a decreasing rate. Similarly, the meaning of the term proportional was better understood, with a pleasing number of candidates able to analyse data from the same task to determine if two quantities were proportional. In the sodium thiosulfate task, many candidates were able to select and use appropriate data to evaluate a claim about reaction time halving as concentration doubles. Similarly, in the best responses candidates were able to sensibly compare spring constants in series and in parallel. Weaker candidates tended to be vague in their responses and needed to consider the specific factor by which variables change in relation to each other to make valid conclusions.

Section B – Improvements

Many candidates were able to suggest suitable improvements, for example using a thermostatically controlled water bath to control temperature in the sodium thiosulfate task or ensuring that they work at eye level when measuring a spring. Where candidates were less successful, they suggested invalid improvements such as only measure the spring when it has stopped moving, which they should have done anyway or referencing controlling the temperature of the entire room in the rates of reaction task.

Section B – Use of practical terms

Most candidates demonstrated clear understanding of practical terms such as repeatability, reproducibility, and accuracy. Similarly, candidates were confident in identifying anomalous results.

Other terms, such as systematic error, were not well understood and most candidates had difficulty in clearly explaining the effect of a systematic error. The glossary of practical terms is a good reference that candidates should use when revising for these tasks.

Section B – Planning

The most effective responses to questions that asked candidates to plan another experiment, included: investigating the effect of a different variable, a list of apparatus, controlled variables and a clear and valid method that could be followed. Less successful attempts at this type of question provided more of a narrative response and frequently did not identify how the independent variable was to be changed and did not state the variables to be controlled and it would not have produced valid data. Simply stating 'repeat the experiment from section A' and then stating one change is not detailed enough to be credited. Candidates should be encouraged to include a chronological list of steps, including stated values of the independent variable, along with reference to what measurements are required.

Section B - Science theory

Theory based questions, such as those involving collision theory in the rates of reaction and enzyme tasks, were often not well answered. Although candidates had a broad understanding, they often didn't use detail and correct terminology in the answers to gain credit. For example, the distinction between collisions and successful collisions was not clearly distinguished or understood

Supporting you

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[i] ***Please note that where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report.***