GCSE Examiners' Report

Applied Science (Single Award)

GCSE

Summer 2024

Introduction

Our Principal examiners' report provides valuable feedback on the recent assessment series. It has been written by our Principal Examiners and Principal Moderators after the completion of marking and moderation, and details how candidates have performed in each unit.

This report opens with a 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 then looks in detail at each unit, pinpointing aspects that proved challenging to some candidates and suggesting some reasons as to why that might be.[1]

The information found in this report provides valuable 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 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 12 months after the examination.	Portal by WJEC 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 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)

[1] ***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.***

Exam Results Analysis	WJEC provides information to examination centres via the WJEC Portal. This is restricted to centre staff only. Access is granted to centre staff by the Examinations Officer at the centre.	Portal by WJEC
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.	Portal by WJEC or on the WJEC subject page.
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Executive Summary

Total entries were similar to 2023, with the vast majority of candidates entered at foundation tier. There was a very small higher tier entry, which was lower than last year. The objective-style question parts at the beginning of the foundation tier question papers were generally well attempted again, with means at similar levels to 2023. This style of questioning which includes underlining answers, selection of answers from a list, scaffolding of calculations etc. made the first 25% of papers more accessible to candidates. However it is worth noting that the not-attempt rates were far higher than on other qualifications in the science suite. Candidates exhibited much better quantitative skills than qualitative skills.

In all exam units, many candidates lacked the basic knowledge and understanding of the topics which meant that performance in recall questions was poor. Where candidates demonstrated some knowledge and understanding, many answers were vague or confused and sometimes did not relate exactly to the question asked.

Questions where candidates were asked to analyse data were variable. Candidates often struggled to include data, where necessary, in their responses. Candidates often didn't read the whole question e.g. underlining choices of data in a table was often missed.

Questions that assessed mathematical skills were also variable. At foundation tier, equations are given in the appropriate form in the question part. However, many candidates substituted incorrectly into given equations. Candidates struggled to convert between units, e.g. between kJ and J. Errors were seen in simple additions and subtractions and rounding errors were often seen. Graph work was inconsistent. Many candidates were unable to produce a linear scale from tabulated data. Candidates often failed to show their workings in calculations, potentially resulting in many lost marks.

QER questions requiring recall of knowledge were answered poorly, e.g. electrolysis. Others, which involved data handling, saw improved quality of responses. Some responses were very difficult to read, with many spelling and capitalisation errors seen. Ones linked to practical work were not answered well.

Questions that drew on understanding of practical skills were answered inconsistently. E.g. candidates were confident in identifying an anomalous result, but few candidates were able to suggest improvements to a given experimental design. The recall of standard key practical terms such as 'repeatability' proved challenging to candidates.

In the task based assessment, pack B was more popular than pack A. However, candidates appeared to perform equally well across both packs. Candidates' performance in this unit was comparable to last year and there were less gaps in candidate scripts than in previous years. 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 was often an issue. Evaluations and risk assessment were the weakest sections.

In the practical unit, the performance of candidates across all the tasks was pleasing with good evidence that candidates were familiar with practical work and the analysis of practical results. Hypotheses were usually well done. Risk assessments were not well done. Candidates were usually able to record their results logically although units were often incorrect and correct rounding was an issue for many candidates. Many produced suitable graphs although many did not produce linear scales or suitable lines of best fit. Key terms such as repeatability and reproducibility were well-known, but many candidates were not clear in their responses and consequently lost marks in explanations.

Areas for improvement	Classroom resources	Brief description of resource
Unit 1: electronic configurations	obtaining_clean_water.pdf (wjec.co.uk) Obtaining resources from our planet 1.3.1 Obtaining clean water - Blended Learning (d3kp6tphcrvm0s.cloudfront.net)	Knowledge organiser: obtaining clean water Blended learning: obtaining clean water
Unit 1: circuits	https://resource.download.wjec.co.uk/vtc/2020-21/el20-21_8-27/Single%20Award/English/electric_circuits.pdf Modern living and energy - Blended Learning (d3kp6tphcrvm0s.cloudfront.net)	Knowledge organiser: building electric circuits Blended learning: building electric circuits
Unit 1: electrolysis	Obtaining resources from our planet - Blended Learning (d3kp6tphcrvm0s.cloudfront.net)	Blended learning: obtaining resources from our planet

Unit 2: collision theory	**CONTROLLING_CHEMICAL_PROCESSES.PDF (WJEC.CO.UK)** **CONTROLLING CHEMICAL REACTIONS - BLENDED LEARNING (D3KP6TPHCRVM0S.CLOUDFRONT.NET)**	Knowledge organiser: controlling chemical processes Blended learning: controlling chemical reactions
Unit 2: reflexes	**EXERCISE_AND_FITNESS_IN_HUMANS.PDF (WJEC.CO.UK)** **HEALTH, FITNESS, AND SPORT 2.3.4 - BLENDED LEARNING (D3KP6TPHCRVM0S.CLOUDFRONT.NET)**	Knowledge organiser: exercise and fitness in humans Blended learning: exercise and fitness in humans
Unit 2: homeostasis of glucose	**FACTORS_AFFECTING_HUMAN_HEALTH.PDF (WJEC.CO.UK)** **HEALTH, FITNESS AND SPORT 2.3.1 - BLENDED LEARNING (D3KP6TPHCRVM0S.CLOUDFRONT.NET)**	Knowledge organiser: factors affecting human health Blended learning: factors affecting human health

APPLIED SCIENCE (SINGLE AWARD)

GCSE

Summer 2024

UNIT 1: FOUNDATION TIER

Overview of the Unit

The exam paper included questions based on all three assessment objectives so tested recall of knowledge, (40%), application and understanding of knowledge, (40%), and analysis, interpretation and evaluation of information (20%). This paper examines topics from the three science disciplines in an applied context.

There was an increase in objective style questions this year. The remainder of the paper was comparable with previous series. It provided a fair test for the candidates at Foundation Tier and differentiated well. The degree of difficulty of questions increased throughout the paper, with questions in the common section providing the most challenge.

The performance of candidates in recall questions was poor. This is nothing new and has been commented on in exam reports for several series.

In some question parts, candidates were asked to include data in their answer. Failure to do so often resulted in no marks being awarded. Candidates needed to take more care when reading all the information. One question part required candidates to complete a table. As a result, it did not have dotted lines to write an answer on. Too frequently, question parts such as this were not attempted. This has been commented on in previous reports.

Some questions that assessed mathematical skills were not well attempted. Equations were given in the appropriate form in the question part. However, too many candidates substituted incorrectly into given equations. They did not consider units during the substitution process. Errors were seen in simple additions and subtractions. Another problematic area was the incorrect rounding of final answers. Workings should be shown in the provided spaces when answering calculation questions. Marks were often provided for selection of values and substitution. These marks could not be awarded if all that was shown was an incorrect answer on the answer line.

Graph work was inconsistent.

The QER question required recall of knowledge. The mean mark and attempt rate were low. Some responses were very difficult to read, and too many spelling and capitalisation errors were seen.

Many question parts had not-attempt rates that were too high. This was particularly surprising for objective style questions.

Comments on individual questions/sections

Q.1 **(a)** Candidates either did not know which planets were rocky and which were gas giants, or they did not read the questions carefully. For example, most candidates selected Jupiter as the rocky planet with the largest diameter.

(b) Despite the instruction in bold to complete the table, about 49% of candidates did not attempt the question. The negative numbers caused problems since the cell in the mean temperature column was less often correct than the cell in the mean distance column.

Q.2 **(a)** **(i)** Mostly correct answers seen but there was also evidence of incorrect subtractions. The not-attempt rate was about 14%.

(ii) The wording in the equation was amended to match information in the table. This was a straightforward single-stage calculation. Less than half of candidates obtained the correct answer. Others substituted correctly so gained a mark but ended up with an incorrect answer. Another group showed no working and gave an incorrect answer. These scored zero. Some random numbers also appeared in the space for calculation. The not-attempt rate was about 24%.

(iii) Less than half of candidates could convert p into £. Some answers seen bore no resemblance to the answer in (ii). The not-attempt rate was about 28%.

(iv) A minority of candidates arrived at the correct payback time. Correct substitutions with incorrect answers were seen. This was usually due to incorrect rounding. The not-attempt rate was about 30%.

(v) It was rare to award both marks here. The not-attempt rate was about 19%. Candidates must be encouraged to attempt objective style questions such as these.

(b) Random selections appear to have been made since few candidates ticked more than one box next to a correct statement. Some candidates did not obey the instruction to tick three (in bold) boxes so automatically penalised themselves. A minority of candidates were able to balance the equation. Symbols and chemical formulae were written in the box.

Q.3 Very few candidates failed to get any credit in this question, but mostly they scored no more than half marks. This was another occasion where candidates did not obey instructions i.e. to place one (in bold) tick in each row.

Q.4 **(a)** Few candidates could give the electronic configuration of chlorine even though sodium was given as an example. The not-attempt rate was about 30%.

(b) Information was provided about what happens to a sodium atom during the reaction to form sodium chloride. If the correct terms were underlined in the brackets, then the sentences would have given the counterargument about a chlorine atom. This was not appreciated by candidates since it was rare to award a mark greater than one. The not-attempt rate was about 20%.

(c) Only a minority of correct answers were seen. A common error was to select $NaCl_2$. The not-attempt rate was about 15%.

(d) Very few correct answers were seen. It was common for elements from other groups to be stated. The not-attempt rate was about 31%.

Q.5 This QER required recall of a practical procedure. The diagram did not promote any relevant description. Responses were very poor resulting in a mean mark in the lower band. The not-attempt rate was about 39%.

Q.6 **(a)** Less than half of candidates were able to give the correct answer. The not-attempt rate was about 48%.

(b) About half of candidates could write down the word equation for the given symbol equation. Others ignored the instruction and just copied the symbol equation into the space provided. The not-attempt rate was about 34%.

(c) An example of the method of completing the table was given in the second row. Despite this, only a minority of candidates could complete the row for oxygen correctly. An ecf was allowed for M_r but quite often, addition errors were seen. The not-attempt rate was about 24%.

Q.7 **(a)** **(i)** When completing the table, most candidates copied across from the neighbouring column. This resulted in 2 marks. A minority read the question carefully enough to give the correct species of the grey squirrel. The not-attempt rate was about 24%.

(ii) Few correct answers were seen. The not-attempt rate was about 28%.

(b) About half of candidates could use the information given in both diagrams to earn a mark in each part. In (i), few described that red squirrels had become less widespread.

(c) **(i) to (iii)** were very structured so that in each part a single-stage calculation was required. Two equations were given that were pre-populated with most of the data required. Other information and data were printed in bold. Despite this, there were errors in selecting the data required to complete the equations and calculations.

(iii) errors were carried forward from both previous parts but not all subtractions were correct. in some cases, the previous values were added. In part (iv), very few marks were awarded. The explanation required values to be included from the graph. This was rarely done. The not-attempt rate for part (c) was about 15%.

Q.8 **(a)** Few correct answers were seen. However, the purpose of a voltmeter was slightly better known than an ammeter. The not-attempt rate was about 26%.

(b) **(i)** Answers were poor with few correct explanations. The not-attempt rate was about 39%.

(ii) Graph work was generally poor. The majority of scales were correct. There were plotting errors. Curves were usually poor and frequently passed through the anomaly. A sizeable minority were unable to produce a linear scale from the tabulated data. They just added the values to the y-axis, equally spaced in numerical order. These scored zero. The not-attempt rate was about 27%.

(iii) Responses were very poor. Even when an explanation was provided, the instruction to use data was ignored. The not-attempt rate was about 41%.

(iv) More often than not, the line was not extended, and if it was, the required point was misread. The not-attempt rate was about 41%.

(v) Stating resistance values at either temperature was insufficient since the difference was required. Few candidates achieved this. The not-attempt rate was about 54%.

(c) This was the least well answered question on the paper with the highest not-attempt rate (63%). No candidate earned any credit.

APPLIED SCIENCE (SINGLE AWARD)

GCSE

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UNIT 1: HIGHER TIER

Overview of the Unit

The exam paper included questions based on all three assessment objectives so tested recall of knowledge, (40%), application and understanding of knowledge, (40%), and analysis, interpretation and evaluation of information (20%). This paper examines topics from the three science disciplines offered in an applied context.

The paper was of comparable difficulty with previous series. It provided a fair test for the candidates at Higher Tier and differentiated well. The degree of difficulty of questions increased throughout the paper.

The performance of candidates in recall questions was poor. This is nothing new and has been commented on in exam reports for several series.

In some question parts, candidates were asked to include data in their answer. Failure to do so often resulted in no marks being awarded. Candidates need to take more care when reading all the information in a question and should follow the instructions given.

Questions that assessed mathematical skills were generally well attempted although outcomes were mixed. Equations were mostly given in the question parts. However, too many candidates substituted incorrectly into given equations. Some errors were seen in simple subtractions. Another problematic area was the incorrect rounding of final answers. Workings should be shown in the provided spaces when answering calculation questions. Marks were often provided for selection of values and substitution. These marks could not be awarded if all that was shown was an incorrect answer on the answer line.

Graph work was quite good.

The QER question required recall of knowledge. The mean mark and attempt rate were low. Some responses were very difficult to read.

Comments on individual questions/sections

Q.1 **(a)** Correct answers were seen in about half of responses.

(b) **(i)** Under half of candidates noticed that the trend had been broken but more selected 6.4 mA as the anomaly than 0.6 mA.

(ii) Graph work was generally quite good. The majority of scales and plots were correct. Curves were usually poor and frequently passed through the anomaly. A small minority were unable to produce a linear scale from the tabulated data. They just added the values to the y-axis, equally spaced in numerical order. These scored zero.

(iii) Responses were poor. Even when an explanation was provided, the instruction to use data was sometimes ignored. Usually, candidates would select one pair of temperatures that doubled, together with the matching resistances, which either proved or disproved the conclusion. Both pairs were required.

(iv) This was answered well.

(v) Stating resistance values at either temperature was insufficient since the difference was required. A minority of candidates achieved this.

(c) Responses were very poor. Few candidates earned any credit. This was the first question on the paper that had a noticeable not-attempt rate (38%).

Q.2 **(a)** Nothing to highlight.

(b) Candidates did not take note of the opening sentence at the start of the question so lots of answers referred to evolution.

(**c**) **(i)** Under half of candidates were able to follow through the stages in the calculation to arrive at the correct answer. Some did not multiply by the area of the forest. Others made substitution and subtraction errors.

(ii) The most common answer stated that red squirrels increased and grey decreased. No data from the graph was included.

(iii) Less than half of candidates could suggest a method. Some ignored the instruction ‘other than trapping’ and gave this method as their answer.

Q.3 **(a)** Some candidates managed to work through the stages to arrive at the correct unit cost. Some made errors or did not to attempt to convert to pence. Others calculated the cost of using gas in 2017 but then stopped at that stage. In some instances, no workings were shown, and the expected answer was not shown on the line. This is a good example where workings could have earned credit even though the final answer was incorrect.

(b) **(i)** Mostly correct answers seen but some subtraction errors were made.

(ii) Few candidates arrived at the correct answer.

(iii) The question specifically stated payback time could be less, but candidates gave answers for a different question i.e. payback time could change.

(c) Candidates were unable to write balanced symbol equations from the information provided despite the inclusion of chemical formulae. The majority could give a difference between elements and compounds.

Q.4 Poor responses in all parts of this question.

(a) candidates gave the symbols of sodium and oxygen rather than the electronic configuration.

(b) very few correct answers were seen. The electronic changes that occur during a reaction between sodium and oxygen were not well known. In this part the not-attempt rate was about 43%. Candidates could not explain in terms of electrons why some alkali metals react less violently than others in part (d).

Q.5 Responses to this QER question were very poor. Candidates demonstrated very little knowledge of the topic. The mean mark was in the lower band. The not-attempt rate was about 26%.

Q.6 **(a)** Few candidates converted 0.6 years to days so were unable to make a valid comparison.

(b) Few candidates realised this was due to carbon dioxide and the greenhouse effect.

(c) Most candidates were unable to use the data to confirm the statement in the question.

Q.7 Responses were poor and the attempt rate dropped significantly in all parts of this question to between 76% and 35%. Candidates' knowledge of electrolysis was lacking. Part (b) was the least well answered question on the paper and part (d) had the highest not-attempt rate (65%).

APPLIED SCIENCE (SINGLE AWARD)

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Summer 2024

UNIT 2: FOUNDATION TIER

Overview of the Unit

The examination paper assessed candidates through a series of questions across a range of topics, comparable with previous examinations in this qualification. The questions tested candidates' recall of knowledge, (40%), application and understanding of knowledge, (40%), and analysis, interpretation and evaluation of information (20%). This paper examined topics from the three science disciplines offered in the science suite, in line with the specification for this qualification.

The examination paper was of comparable demand with those of the previous series; the assessment differentiated across a range of candidates. The questions progressed in their degree of difficulty and challenge, whereby the most challenging questions occurred towards and within the common tier section of the examination. The initial questions in the examination proved accessible to all/most candidates and candidates scored well.

Recall questions were well answered within the first few questions of the paper, where the recall required shorter answers or a choice of answers from suggestions given. Further into the examination paper, where recall required scientific explanation or more complex interpretation, candidates struggled to recall and then correctly apply their knowledge and understanding.

Questions that drew on understanding of practical skills were answered somewhat inconsistently. Candidates were confident in identifying an anomalous result. Few candidates were able to suggest improvements to a given experimental design. The recall of standard key practical terms such as 'repeatability' proved challenging to candidates, whereas these are standard terms that are well responded to within practical examinations.

Questions that assessed mathematical skills were generally well attempted. Candidates were quite confident in analysing data presented in graph format. However, they were inconsistent in correctly quoting data to evidence trends in graphs. Candidates could generally be credited with marks when they attempted to interpret the distance-time graph which formed the QER question. A number of candidates scored well as they were confident in interpreting the data posed, though the overall mean mark fell within the lower band. Some candidates were confident in expected mathematical skills such as substituting into an equation and calculating a mean. Candidates should be aware of the need to correctly round numerical answers, as marks were lost here. It is emphasised that workings should be shown in the provided spaces when answering calculation questions. Marks were often provided for selection of values and substitution. These marks could not be awarded if all that was shown was an incorrect answer on the answer line.

Most candidates were able to plot the given points onto a graph. However, a significant number of candidates did not add any scale to the x-axis and therefore the plots could not be assessed as being correct. Many candidates added a correct x-axis scale, however the zero at the origin was frequently omitted - this prevented the mark being awarded. Candidates would benefit from practice of curved lines of best fit and an understanding that dot-to-dot is not acceptable (outside of a biological context).

Questions that required evaluation of a conclusion (an A03 skill) were attempted by more candidates and more correctly answered than questions that required improvement to experimental design (also an A03 skill). As in previous examination series, A03 skills pose the overall greatest challenge.

Comments on individual questions/sections

Q.1 **(a)** The question was accessed and correctly answered by the vast majority of candidates. Candidates had a greater understanding of red and white blood cells than platelets.

(b) Candidates scored well and the question was accessed by the vast majority of candidates.

Q.2 **(a)** Significantly high accessibility and candidates scored well. A small number of candidates need to ensure they do not omit questions which lack a dotted line to answer upon.

(b) Candidates accessed the question well. Correctly identifying the greenstick fracture posed the greatest challenge.

Q.3 **(a)** Candidates were inconsistent in identifying the role of the tendons though they were confident in the term 'antagonistic' to describe the muscles. The description of the action of the biceps and triceps was answered poorly. Key terms such as 'contract' and 'relax' were omitted, with a number of candidates incorrectly stating that muscles push.

(b) Most candidates read the graph correctly and went on to conclude the stronger right or left arm correctly. Candidates needed to quote data from the graph to gain further marks and state their conclusion clearly, naming the pupil/s from the question. Extending the investigation was answered with less confidence, though a large number of candidates understood the need to involve more people in a further investigation. Reading the examination question more carefully would be of benefit as this gave ideas regarding widening the geographical area, using a range of ages etc.

Q.4 **(a)** This QER question had a good accessibility rate compared to previous examination series - over 90% of candidates attempted the question. Candidates showed greater confidence in quoting data directly from the graph, but lesser confidence in linking key scientific meaning to the patterns within the graph. There was some misinterpretation regarding the areas showing constant speed and stationary (lack of) motion. This prevented a number of candidates reaching the upper band. Some candidates could identify where a steeper graph line equated to greater speed.

(b) About half of the candidates attained full marks here. The most common mistake was calculating the entire journey at 800 m, this then served as an error carried forward.

(c) Just under 90% of candidates attempted the question. Some candidates gained marks for substitution and showing their workings. A significant number of candidates lost marks through incorrect rounding of the final answer.

Q.5 **(a)** The question was accessible to the majority of candidates. Almost all candidates stated the use of eye protection but in a significant number of cases this was negated by giving a list of irrelevant PPE to this hazard and risk e.g. gloves and aprons.

(b) Over half of the candidates could correctly identify the anomalous result within the table. Exemplifying the calculation of the mean score was answered well by a small number of candidates. Mean workings needed to be shown here as a calculation rather than described - a number of candidates lost marks as they answered in a purely descriptive manner. Candidates were confident in plotting points on the graph, though a large number omitted the x-axis scale and therefore the accuracy of the plots could not be assessed and marks were lost. Candidates need to ensure that a zero is placed at the origin. The line of best fit proved a challenging curve. 20% of candidates did not attempt to describe and then interpret the graph trend. From the candidates who attempted the question, greater confidence was shown in describing the trend compared to the application of knowledge required to explain it. Candidates need to use correct terminology e.g. ‘concentration’ and not ‘strength’. Application of knowledge regarding collision theory was poor. Candidates found the evaluation of data logger use challenging. For example, they did not discuss the reduction of human error in judging the disappearance of the black cross.

Q.6 **(a)** Candidates generally understood the link between temperature increase and energy. However, candidates needed to be more exact in their scientific expression at this point in the examination paper e.g. discussing “temperature increase” rather than the experiment getting ‘hotter’.

(b) Improving experimental design was poorly answered throughout the examination paper. Even with a standard specified practical such as this, few candidates understood that energy was lost between the flame and the tube and these needed to be brought closer together. A significant number of candidates incorrectly thought that a greater mass of crisps was an improvement to the experimental design.

Q.7 **(a)** This question was very poorly answered. Few candidates understood the concept of half-life and how the number of half-lives/fraction remaining could be calculated. Candidates would have benefitted from showing their workings as marks could have been awarded for calculating the number of half-lives.

(b) and (c) Although over 82% of candidates attempted these questions, they were poorly answered. Candidates correctly selected and stated the information from the table, but candidates had very little understanding as to why a gamma source or a longer/shorter half-life was preferable for the stated use. The linking of key knowledge and the application of this to a standard scenario proved challenging.

Q.8 **(a)** Although a significant number of candidates accessed the question and described the repeating of results, there were some clear misconceptions. Candidates omitted to state that repeatability was linked to checking for similar or anomalous results. Understanding of 'reproducibility' was poor.

(b) Candidates did not understand the meaning of the term proportional. This resulted in candidates describing the general trend in the data rather than quoting the data to justify proportionality.

(c) This question had a low accessibility rate of only 67%. It was disappointing that candidates rarely identified the reaction as being exothermic.

Q.9 **(a)** Over 80% of candidates accessed the question. However, there was little understanding that the data was presented in this manner to enable comparison between regions.

(b) The data presented within the question was generally understood by candidates- only 10% of candidates did not engage with the data. A greater number of candidates were credited for the outbreak starting in London, though candidates tended not comment on all three geographical areas. Candidates understood that a greater population is located within cities; some candidates linked this explanation to closer proximity and an increased chance of viral transfer. A significant number of candidates misunderstood when a vaccination should be administered, thinking that this should happen at the height of the outbreak.

(c) Only 6.5% of candidates did not access this question. However, a significant number of candidates lacked correct use of the technical language required to attain marks. Few candidates recalled that the flu virus can mutate.

APPLIED SCIENCE (SINGLE AWARD)

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UNIT 2: HIGHER TIER

Overview of the Unit

The examination paper assessed candidates through a series of questions across a range of topics, comparable with previous examinations in this qualification. The questions tested candidates' recall of knowledge, (40%), application and understanding of knowledge, (40%), and analysis, interpretation and evaluation of information (20%). This paper examined topics from the three science disciplines offered in the science suite, in line with the specification for this qualification.

The examination paper was of comparable demand with those of the previous series; the assessment differentiated across a range of candidates. Question 1 and 2 were common with the Foundation Tier paper. The questions progressed in the degree of difficulty and challenge, whereby the least challenging questions occurred within the common tier section of the examination, and the more challenging questions towards the end of the paper.

Generally, candidates did well in applying knowledge when data was given (Questions 2, 8b), but did not perform as well when pure recall was needed (AO1) (Questions 4(c) 8(a)). This was particularly noticeable in the QER question (Question 7).

As in previous series the skills needed for AO3 (improving experimental design) proved challenging for candidates. There was still a confusion between improving repeatability and reproducibility and methods that improve accuracy or reduce uncertainty**.**

Generally, mathematical problems were tackled well (Questions 5(c), 6). However, converting units was difficult for many candidates (Question 2(a) & (b), as was giving the unit for acceleration (Question 6(a)).

Comments on individual questions/sections

Q1 **(a)** Most candidates described the repeating of results but failed to state that repeatability was linked to checking for similar results or reducing the effect of anomalies. Similarly, in (ii) candidates who realised that the experiment should be done by others failed to explain why this was done.

(b) Candidates mostly described the general trend in the data rather than quoting the data to justify proportionality.

(c) Most candidates identified the reaction as being exothermic. However, their answers were often not related to bond energies.

Q.2 **(a)** A minority of candidates realised figures were quoted in such a way for comparison.

(b) The data presented within the question was generally understood by candidates. Candidates understood that there was a greater population in cities and linked this explanation to closer proximity. A minority then noted that this led to an increased chance of viral transfer. Very few candidates realised that vaccines must be given before the disease starts spreading.

(c) This part was generally well answered by the majority of candidates.

Q.3 **(a)** The majority of candidates scored 2 marks out of 3, losing a mark for not converting the units from J/g to kJ/g.

(b) **(i)** Only a small minority spotted that the 285 kJ was for 100 g and needed to be converted to per gram to be consistent with part (a).

(ii) Only a few candidates achieved any marks in this part, most gave repeatability or reproducibility-type answers rather than ways of reducing the heat loss.

Q.4 **(a)** Most candidates scored at least one mark on this part by spotting that variables needed to be controlled.

(c) In this question part, many candidates found it difficult to express their ideas about surface area, often using incorrect terminology, or omitting important concepts. Answers such as 'the rate of reaction goes up due to the surface area we lose' were common - linking words from the stem but showing no understanding.

Q.5 **(a)** Candidates could generally interpret the graph.

(b) Most candidates scored at least one mark for knowing that insulin is produced in the pancreas, but only the more able candidates understood about how glucose is converted, stored and transported.

(c) This question part was well answered but a common mistake was forgetting to square the height.

Q.6 Most candidates scored well in parts (a) and (c), although the mark for units was surprisingly seldom scored. Higher scoring candidates often scored all 4 marks in part (b), many lower scoring candidates simply multiplied 12 × 360.

Q.7 **(a)** The QER question was poorly answered. Many candidates did not know the names of the neurons. Many thought that neurons moved.

(b) Candidates showed poor recall again in this question part.

Q.8 A lack of recall was again evident in part (a), although the Punnett square was generally well attempted. Many candidates gave the probability for an affected child, rather than an unaffected child as the final answer.

Q.9 **(a)** Many candidates scored at least one mark for calculating that 26 years passed between the accident and removal of restrictions. Only a very few then went on to use the data in the graph to work out that the count rate had fallen below 1000 Bq. The higher scoring candidates were able to use the graph to read across at 1600 Bq to give a time of 12 years, and then add the 26 years and read up at 38 years to give 900 Bq (less than 1000 Bq so safe).

(b) This part was generally well done.

(c) Candidates who recalled the beta particle correctly tended to complete the equation correctly.

APPLIED SCIENCE (SINGLE AWARD)

GCSE

Summer 2024

UNIT 3: FOUNDATION TIER

Overview of the Unit

All AOs are assessed in this unit. Both packs tested candidates' ability to: plan; assess risk; carry out experiments; make measurements and record them; analyse data; and to evaluate methods and data.

Pack A tested candidates' ability within the topics of: Protecting our environment; and World of life. Pack B tested candidates ability within the topics of: Building electric circuits; and Obtaining clean water.

Pack B was much more popular than Pack A. However, candidates appeared to generally perform equally well across both packs.

Candidates' performance in this unit was comparable with last year. Candidates' ability to answer questions fully continues to improve, and many fewer candidates were leaving questions blank.

Comments on individual questions/sections

Activity 1
Task A Planning

On average, candidates scored just over 40% on this Task. Some candidates were still confused by the terms: independent; dependent and controlled variables. The ability to choose from a list of possible variables allowed more candidates to correctly select the correct reason for why each chemical reaction was performed on each of the solutions from Pack A; and the variables from Pack B, particularly as those were generally identifiable from the Introduction section. Some candidates attempting Pack B still had problems identifying the controlled variables. Many candidates from Pack A failed to draw meaningful labelled diagrams of the apparatus, and effectively only drew a list of apparatus. Some candidates did not include correct labels of all the reagents used and others failed to label the glassware and other pieces of apparatus needed.

Many candidates from Pack B failed to draw a correct circuit diagram of the experiment. Common errors included: failing to draw an obviously complete series circuit; inclusion of unnecessary components, such as a voltmeter; and incorrectly drawing circuit symbols. Most candidates in both Packs 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. Generally, candidates did slightly better on Pack B, as many candidates attempting Pack A failed to link all the positive tests to the methods, and the need to perform all three tests on all the unknown solutions and observe/record all the results for each test.

Candidates do need to be able to spell key scientific words correctly. These are generally words that can be found in the Introduction section to the Activity. Centres do need to remind their candidates to check that their methods include all the necessary requirements set out in the Task instructions.

Candidates continue to find constructing a risk assessment difficult.

Centres are reminded to run through the general structure of a CLEAPSS Student Safety Sheet, as most 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. 0.1 mol/dm^3 silver nitrate is an irritant; the power resistor will get hot) – the specific nature for chemicals is lifted straight off the Student Safety Sheet. Please note, candidates should always state the concentration of solutions if it is given, as this determines the level of the nature of the hazard.
- Risks must have an injury and an action (e.g. hot resistor could burn the skin whilst connecting/disconnecting/dismantling the circuit; chemical could irritate the eyes/skin if splashed during testing/handling). A significant minority of candidates correctly identified the relevant injuries, but did not state the action. Please make candidates aware that some identified chemical hazards, are now classified as 'currently not classified as hazardous', replacing the 'low hazard' description on previous versions of the Student Safety Sheets. In this case, 'No specific risk' and 'No specific control measures' are appropriate responses. Risks must be related to the hazard.
- Control measures need to be appropriate for the stated hazard and risk. For example, from Pack B, when circuit components get hot, they should not be handled until they have cooled down. Some control measures for chemicals are specified on the relevant Student Safety Sheet. (e.g. wear eye protection/goggles).

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 attempting Pack B failed to write the resolution of their ammeter. The most common mistakes for those candidates attempting Pack A were to omit all the negative test results; and to not include a column for the identity of their unknown solutions. The vast majority of candidates attempting Pack B managed to take repeated readings across the stated voltage range, with many obviously taking care to ensure that their repeats were similar to each other. A small minority of candidates only repeated their measurements once. For Pack B-type activities, some candidates still need practice with listing all the units on tables and making sure that they do not include the units in the body of the table. A significant minority of candidates still struggled to use the correct (consistent) number of decimal places on columns of numbers, particularly when calculating means. A significant minority of tables were very scrappy, particularly with Pack A. 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 most common difficulties involved not including the cation, sodium, on many of their answers for Pack A; and plotting the graphs/charts, and performing calculations, for Pack B. Most candidates attempting Pack A were able to correctly identify the unknown solutions A, B and C. A significant number of candidates did not link their identification of each unknown to the correct positive test outcome. Most candidates attempting Pack A were able to give a reason for why a test for sodium was not needed, and were able to state how they would know if a tube contained two or more solutions.

Candidates had more problems identifying the unknowns from the given table, and a significant minority obviously mixed up their answers. Many candidates did not identify the set of solutions that was not used. For Pack B-type activities, 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 places as the (primary) data.

This was an issue for a significant minority of candidates from Pack B. Candidates still found it very challenging to produce accurate graphs/charts. Common mistakes involved: non-linear, and inappropriate scales; inaccurate point plotting; and poor best-fit line drawing (if appropriate). It was pleasing to see that most candidates were able to describe the pattern in their results for Pack B. This pack also required candidates to extract information from their graph. Most candidates were able to correctly read a value from their graph, and were able to correctly draw the second line for resistor B. A significant minority then struggled to identify and explain which resistor would be the better choice for the hand warmer.

Task D Evaluation

As continues to be the pattern, candidates found the evaluation component of any Task, hardest, and on average, candidates only scored just over 25% of the available marks. When asked about the suitability of the experiment, many candidates wrote about their own performance during the experiment or stated that the method was easy to follow. Candidates needed to either examine the pattern in the data or give a comment about the uncertainty of the data. Candidates still need to be more aware of the meaning of repeatability. Pack B asked candidates to assess the repeatability of their data and a significant minority still referred to all their data being similar, when they should have focused on the similarity of their repeated data values.

Pack A asked candidates to assess why it was not necessary to repeat each chemical test, and many simply stated that they had the correct answer and did not explain why. Candidates were better at spotting inaccuracies and suggesting improvements, although extensions to an investigation were not considered to be improvements. Many candidates found explaining the suggestion/agreement question at the end of this section for Pack B 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. In this case candidates could use their graph or give examples from their data to support their answer.

Activity 2

Task A Analysis

Candidates, on average, scored over 50% of the available marks for this section. Many Pack A candidates struggled to describe the pattern of Graph 1, often not mentioning the peak in the graph. Very few candidates correctly estimated the two heights that a 3.8 cm long berberis spike could have come from – reading the scale correctly proved to be the biggest issue. Many candidates also omitted to circle the anomaly, but most were able to calculate the missing mean correctly and were able to complete Table 2 correctly. Many candidates in Pack A were unable to plot the points of the mean spikiness v height up a holly bush graph accurately, and many failed to draw an accurate best-fit line. Join-the-dots was accepted for the graph, but many candidates still did not get the mark due to their inaccuracy drawing the joining lines.

A significant majority of candidates attempting Pack A were able to state and explain which bush they would choose, linking their answer to the spikes on the chosen plant. Many candidates attempting Pack B did not circle the anomalous value in the table, suggesting that they did not read the questions carefully. Most attempted to calculate the missing mean values, but frequently did not remove the anomaly, or did not round their answers correctly. Most candidates were able to plot the data accurately, but most struggled to draw a suitable best fit line – a smooth curve or join-the-dots was accepted in this case.

Most candidates found the calculations challenging, particularly with rounding. Most candidates were able to state the pattern correctly, but then struggled to estimate the safe extraction distance from the graph. Candidates were quite good at extracting information from text or from tables, and most candidates were able to analyse the food web correctly.

Task B Evaluation

As has been the case historically, candidates still find evaluations very challenging, and only scored just over 25% on average.For Pack A, candidates were asked about the suitability of the experiment and the successful ones were able to express how the method allowed students to correctly identify a pattern in the results. A significant minority of candidates were unable to suggest a correct comment about the variation in the spikiness of holly leaves up a holly bush, although examiners also accepted answers based on an analysis of the variation of spikes per leaf within at least one height category. A significant number of candidates were able to state at least one possible source of inaccuracy, usually involving measuring the height up the holly bush, but then struggled to state a second (correct) inaccuracy. Most candidates were able to suggest a suitable improvement, frequently referencing the need to test more leaves.

For Pack B, when asked about the suitability of the experiment, many candidates wrote about the method being easy to follow. Candidates needed 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 three samples were tested at each distance from the sea. Most candidates that gained credit, mentioned the need to calculate a mean value. A small minority wrote about spotting anomalies or reducing uncertainty.

Most candidates attempting Pack B were able to suggest correct reasons why the sample bottles were shaken for 2 minutes and then dried for 24 hours. Only a small minority of candidates were able to give a correct reason for why taking samples with a distance interval of 25 m, rather than 500 m was not a good suggestion. Many candidates focused on the length of time that the experiment would take rather than smaller change in the mass of solids.

APPLIED SCIENCE (SINGLE AWARD)

GCSE

Summer 2024

UNIT 3: HIGHER TIER

Overview of the Unit

All AOs are assessed in this unit. Both packs tested candidates' ability to: plan; assess risk; carry out experiments; make measurements and record them; analyse data; and to evaluate methods and data.

Pack A tested candidates' ability within the topics of: Protecting our environment; and World of life. Pack B tested candidates' ability within the topics of: Building electric circuits; and Obtaining clean water.

Pack B was much more popular than Pack A. However, candidates appeared to generally perform equally well across both packs.

Candidates' performance in this unit was comparable with last year. Candidates' ability to answer questions fully continues to improve, and many fewer candidates were leaving questions blank.

Comments on individual questions/sections

Activity 1

Task A Planning

On average, candidates scored just under 40% on this Task. Some candidates were still confused by the terms: independent; dependent and controlled variables. Most candidates attempting Pack A were able to give the correct reason for why each chemical test was performed on each of the solutions; but as has been the case in the past, candidates attempting Pack B frequently omitted stating any of the variables even though these were generally identifiable from the Introduction section. Many candidates from Pack A failed to draw meaningful labelled diagrams of the apparatus, and effectively only drew a list of apparatus. Some candidates did not include correct labels of all the reagents used and others failed to label the glassware and other pieces of apparatus needed.

Many candidates from Pack B failed to draw a correct circuit diagram of the experiment. Common errors included: failing to draw an obviously complete series circuit; inclusion of unnecessary components, such as a voltmeter; and incorrectly drawing circuit symbols. Most candidates in both Packs 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. Generally, candidates did slightly better on Pack B, as many candidates attempting Pack A failed to link all the positive tests to the methods, and the need to perform all three tests on all the unknown solutions and observe/record all the results for each test. Candidates do need to be able to spell key scientific words correctly. These are generally words that can be found in the Introduction section to the Activity. Centres do need to remind their candidates to check that their methods include all the necessary requirements set out in the Task instructions.

Candidates continue to find constructing a risk assessment difficult. Centres are reminded to run through the general structure of a CLEAPSS Student Safety Sheet, as most 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. 0.1 mol/dm^3 silver nitrate is an irritant; the power resistor will get hot) – the specific nature for chemicals is lifted straight off the Student Safety Sheet. Please note, candidates should always state the concentration of solutions if it is given, as this determines the level of the nature of the hazard.
- Risks must have an injury and an action (e.g. hot resistor could burn the skin whilst connecting/disconnecting/dismantling the circuit; chemical could irritate the eyes/skin if splashed during testing/handling). A significant minority of candidates correctly identified the relevant injuries, but did not state the action. Please make candidates aware that some identified chemical hazards, are now classified as 'currently not classified as hazardous', replacing the 'low hazard' description on previous versions of the Student Safety Sheets. In this case, 'No specific risk' and 'No specific control measures' are appropriate responses. Risks must be related to the hazard.
- Control measures need to be appropriate for the stated hazard and risk. For example, from Pack B, when circuit components get hot, they should not be handled until they have cooled down. Some control measures for chemicals are specified on the relevant Student Safety Sheet. (e.g. wear eye protection/goggles).

Task B Collecting and recording

This section continues to be the highest scoring section, with candidates, on average, scoring 80% of the marks available. Many candidates attempting Pack B failed to write the resolution of their ammeter. The most common mistakes for those candidates attempting Pack A were to omit all the negative test results; and to not include a column for the identity of their unknown solutions. The vast majority of candidates attempting Pack B managed to take repeated readings across the stated voltage range, with many obviously taking care to ensure that their repeats were similar to each other. A small minority of candidates only repeated their measurements once. For Pack B-type activities, some candidates still need practice with listing all the units on tables and making sure that they do not include the units in the body of the table. A significant minority of candidates still struggled to use the correct (consistent) number of decimal places on columns of numbers, particularly when calculating means. A significant minority of tables were very scrappy, particularly with Pack A. 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

On average, candidates scored just over 45% of the available marks for this section. The most common difficulties involved not including the cation, sodium, or potassium on many of their answers for Pack A; and plotting the graphs/charts, and performing calculations. Most candidates attempting Pack A were able to correctly identify the unknown solutions A, B and C. Most candidates attempting Pack A were able to give a reason for why a test for sodium was not needed and were able to state how they would know if a tube contained two or more solutions. Candidates had more problems identifying the unknowns from the given table, and a significant minority obviously mixed up their answers. The mixed tubes for Set 4 caused some issues for a significant minority of candidates. Many candidates did not correctly identify the set of solutions that was not used but did correctly suggest a way that the solutions may have become contaminated.

For Pack B-type activities, 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 places as the (primary) data. This was an issue for a significant minority of candidates from Pack B. Candidates still found it very challenging to produce accurate graphs/charts. Common mistakes involved: non-linear, and inappropriate scales; inaccurate point plotting; and poor best-fit line drawing (if appropriate). Candidates in Pack B particularly found drawing a best fit line a challenge. Centres should continue to give candidates lots of practice on this skill and give plenty of opportunities to plot both line graphs and bar charts.

It was pleasing to see that most candidates were able to describe the pattern in their results, for Pack B. This required candidates to extract information from their graph. Most candidates were able to correctly read a value from their graph, and were able to correctly draw the second line for resistor B. The calculations in Pack B were quite straightforward but a significant minority of candidates lost marks because they were unable to round their answers to the correct number of significant figures. Most higher tier candidates were able to identify and explain which resistor would be the better choice for the hand warmer.

Task D Evaluation

As continues to be the pattern, candidates found the evaluation component of any Task, hardest, and on average, candidates only scored just over 35% of the available marks. When asked about the suitability of the experiment, many candidates wrote about their own performance during the experiment, or stated that the method was easy to follow.

Candidates needed to either examine the pattern in the data or give a comment about the uncertainty of the data. Candidates still need to be more aware of the meaning of repeatability. Pack B asked candidates to assess the repeatability of their data and a significant minority still referred to all their data being similar, when they should have focused on the similarity of their repeated data values. Pack A asked candidates to assess why it was not necessary to repeat each chemical test, and many simply stated that they had the correct answer and did not explain why. Candidates were better at spotting inaccuracies and suggesting improvements, although extensions to an investigation were not considered to be improvements. Many candidates found explaining the suggestion/agreement question at the end of this section for Pack B a challenge. Candidates should take more time reading this question, and thinking about a suitable response, before writing their final answer. There was no credit for a simple Yes/No answer, an explanation was needed. In this case candidates could use their graph or give examples from their data to support their answer.

Activity 2

Task A Analysis

Candidates, on average, scored just over 55% of the available marks for this section. Most Pack A candidates were able to sketch the graph from Table 4 correctly, but they then struggled to explain why it was not possible to determine exactly where a berberis spike that was 3.8 cm long came from. Many candidates also omitted to circle the anomaly, but most were able to calculate the missing mean correctly and were able to complete Table 2 correctly. Many candidates in Pack A were unable to plot the points of the mean spikiness v height up a holly bush graph accurately, and many failed to draw an accurate best-fit line. Join-the-dots was accepted for the graph, but many candidates still did not get the mark due to their inaccuracy drawing the joining lines. A significant minority did not label the axes correctly or did not have a suitable linear scale. A significant majority of candidates attempting Pack A were able to state and explain which bush they would choose, linking their answer to the spikes on the chosen plant. A significant minority of higher tier candidates attempting Pack B did not circle the anomalous value in the table, suggesting that they did not read the questions carefully.

Most attempted to calculate the missing mean values, but frequently did not remove the anomaly, or did not round their answers correctly. Most candidates were able to plot the data accurately, but most struggled to draw suitable best fit lines – smooth curves or join-the-dots was accepted in this case. A significant majority of higher tier candidates were unable to state the pattern between the two variables correctly, and often were only able to state the pattern of each of the two graphs, which was not asked. Most were able to estimate the safe extraction distance from the graph. Candidates were quite good at extracting information from text or from tables, and most candidates were able to analyse the food web correctly.

Task B Evaluation

As has been the case historically, candidates still found evaluations very challenging, and only scored over 40% on average. For Pack A, candidates were asked about the suitability of the experiment and the successful ones were able to express how the method allowed students to correctly identify a pattern in the results. A significant minority of candidates were unable to suggest a correct comment about the variation in the spikiness of holly leaves up a holly bush, although examiners also accepted answers based on an analysis of the variation of spikes per leaf within at least one height category. A significant number of candidates were able to state at least one possible source of inaccuracy, usually involving measuring the height up the holly bush, but then struggled to state a second (correct) inaccuracy. Most candidates were able to suggest a suitable improvement, frequently referencing the need to test more leaves. For Pack B, when asked about the suitability of the experiment, many candidates wrote about the method being easy to follow.

Candidates needed 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 three samples were tested at each distance from the sea. Most candidates that gained credit, mentioned the need to calculate a mean value. A small minority wrote about spotting anomalies or reducing uncertainty.

Most candidates attempting Pack B were able to suggest correct reasons why the sample bottles were shaken for 2 minutes and then dried for 24 hours. Only a small minority of candidates were able to give a correct reason for why taking samples with a distance interval of 25 m, rather than 500 m was not a good suggestion. Many candidates focused on the length of time that the experiment would take rather than smaller change in the mass of solids

APPLIED SCIENCE (SINGLE AWARD)

GCSE

Summer 2024

UNIT 4: PRACTICAL ASSESSMENT UNIT

Overview of the Unit

In this unit candidates are assessed on their practical skills including forming hypotheses, 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 performance of candidates across all the tasks was pleasing with good evidence that candidates were familiar with practical work and the analysis of practical results. The tasks all proved to be accessible for most candidates who usually attempted all sections.

Hypotheses were usually well done. Risk assessments were not well done. Candidates were usually able to record their results logically although units were often incorrect and correct rounding was an issue for many candidates. Many produced suitable graphs although many did not produce linear scales or suitable lines of best fit. Key terms such as repeatability and reproducibility were well-known, but many candidates were not clear in their responses and consequently lost marks in explanations.

Comments on individual questions/sections

Most candidates were able to make a sensible hypothesis in each of the 9 tasks, which linked the independent and dependent variables. The exception to this was the exothermic reactions experiment, where many candidates simply stated that the temperature would rise when zinc was added and did not link temperature and time.

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, for example stating simply that water can burn you with no reference to either the action of pouring or the affected body part. It was still common to see reference to chemicals splashing into eyes which earns no credit. It was also very common for candidates to create a risk for experiments where there were no significant risks.

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. Incorrect units such as C° or use of incorrect abbreviations of units (e.g. secs for s / seconds) was commonly seen, especially in the sweating tubes practical. In that task many candidates struggled to organise their table of results sensibly. In the exothermic reactions task, candidates were instructed to record the time every 30 seconds for 3 minutes.

It was common to see the time recorded incorrectly with candidates recording 1.3 minutes for a time of 1 minute 30 seconds. Handwriting was an issue for many candidates, and particularly the legibility of numbers. In the cake cases experiment, candidates were required to determine the mean from 3 numbers. Almost all candidates knew how to calculate the mean, but errors in rounding their final answer meant that this mark was withheld.

Section B – Variables

Each of the 9 tasks included a section on variables. Candidates were usually able to identify the independent and dependent variables, and most were able to state the range of these variables when required. Many of the tasks explored how certain variables were controlled, and in common with previous series this was not well answered, with no clear indication of the apparatus used or the required measurement of that variable.

Section B – Graphs

The most successful candidates obtained most of the available marks in this section. However, a significant number of candidates made common errors that have been seen in past series. The choice of non-linear scales, particularly in the cake cases task, was commonly seen with many candidates scaling their *x*-axis in reverse. Many candidates also lost the scale mark as they failed to record a value at the origin. Where candidates chose sensible scales, plotting was usually accurate with errors mainly seen in plotting where multiples of values such as 0.15 were used. Lines of best-fit continued to be problematic as many candidates simply joined the first and last point with no consideration of the spread of data above and below the line. Joining point-to-point is only usually acceptable in Biology tasks but this was seen commonly in all tasks.

Description of the results was often quite limited. Whilst the majority of candidates were able to describe a relationship between the independent and dependent variables in the graph, a description of the shape of the graph, where it was required for the second mark, was poor. A significant number of candidates do not understand “directly proportional” correctly.
In the exothermic practical, candidates would link the temperature increase to time but not follow this with a description of the subsequent decrease or levelling off.

Section B - Calculations

Across all the tasks, where candidates were asked to use equations, calculations were answered well by most candidates; these included calculations of speeds, heat energy released and uncertainty. Some candidates did confuse units particularly in the cup case speed calculation where m/s was used for cm/s calculations and vice versa.

Section B – Explanation of results

Linking practical results to underlying theory proved again to be challenging for many candidates. In the exothermic reaction task, many candidates failed to clearly link their results to the reaction pathway. Similarly, in the cake cases task, only the most successful candidates recognised that the speed should have been consistent and could sensibly comment on their results.

Section B – Use of practical terminology

It was evident that most candidates understood practical terminology such as repeatability, reproducibility and precision and understood what an anomalous result is. The most successful candidates were able to evaluate repeatability and use data to justify their responses. However, many candidates, whilst clearly understanding the meaning of the terminology, gave answers to questions that were too vague for credit, with responses such as all the results are similar, rather than focusing on the similarity of repeats. Poorer responses were characterised by a lack of reference to the data collected or presented.

Section B – Improvements

Many candidates were able to suggest suitable improvements, for example using a lid for insulation in the exothermic reaction experiment or video recording the drop in the cake cases experiment. Where candidates were less successful, they often used vague descriptions of improvements with no suggestion of how these would be used. There seemed to be a lack of knowledge or experience of higher precision instruments such as a burette or graduated pipette from many candidates in some centres.

Supporting you

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