GCSE Examiners' Report

Applied Science (Double 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.
Become an examiner with WJEC.	We are always looking to recruit new examiners or moderators. These opportunities can provide you with valuable insight into the assessment process, enhance your skill set, increase your understanding of your subject and inform your teaching.	Become an Examiner | WJEC

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Executive Summary

The number of candidates, particularly at foundation tier increased once again compared to 2023. The vast majority of candidates were entered for foundation tier units. The objective-style question parts at the beginning of the foundation tier question papers were generally well attempted again, with unit means at comparable or higher 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. Candidates exhibited much better quantitative skills than qualitative skills.

In all exam units however, 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. completing a circuit diagram 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. They did not consider units during the substitution process, and often incorrectly converted e.g. between cm and m. Errors were seen in simple additions and subtractions, calculating means and percentages. Another problematic area was incorrect rounding of final answers. Graph work was inconsistent. Many candidates were unable to produce a linear scale from tabulated data.

The pre-release in Unit 2 was worth 25 marks (19 overlapping) and none of the questions relied on recall.

QER questions requiring recall of knowledge were answered poorly. Some responses were very difficult to read, with many spelling and capitalisation errors seen.

In the task based assessment, pack B was more popular than pack A. However, candidates appeared to generally 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 knowledge of 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: hard and soft water	1-3-1_obtaining_clean_water-2.pdf (wjec.co.uk) https://d3kp6tphcrvm0s.cloudfront.net/el20-21_10-19	Knowledge organiser 1.3.1: obtaining clean water Blended learning resource 1.3.1: obtaining clean water
Unit 1: diffusion	1-1-1_the_cell_and_respiration.pdf (wjec.co.uk) The cell and respiration - Blended Learning (d3kp6tphcrvm0s.cloudfront.net)	Knowledge organiser 1.1.1: the cell and respiration Blended learning resource 1.1.1: the cell and respiration
Unit 2: vaccines	2-3-3_fighting_disease.pdf (wjec.co.uk) Health fitness and sport 2.3.3 - Blended Learning (d3kp6tphcrvm0s.cloudfront.net)	Knowledge organiser 2.3.3: fighting disease Blended learning resource 2.3.3: health, fitness and sport
Unit 2: testing of new drugs	2-3-2_diagnosis_and_treatment.pdf (wjec.co.uk) Health, fitness and sport 2.3.2: Diagnosis and treatment - Blended Learning (d3kp6tphcrvm0s.cloudfront.net)	Knowledge organiser 2.3.2: diagnosis and treatment Blended learning resource 2.3.2: diagnosis and treatment

Unit 3: exothermic and endothermic reactions	Resource WJEC Educational Resources Website	Blended learning resource 3.4.1: controlling chemical reactions
Unit 3: fermentation	food_processing_and_spoilage.pdf (wjec.co.uk) Resource WJEC Educational Resources Website	Knowledge organiser 3.2.2: food processing and spoilage Blended learning resource 3.2.2: food processing and spoilage

APPLIED SCIENCE (DOUBLE AWARD)

GCSE

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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%). The Applied Science examination papers cover biology, chemistry and physics topics, set in an applied context.

There was an increase in objective style questions this year. Performance in these questions was generally good. 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 objective style question parts were generally well attempted. This style of questioning made them more accessible to candidates. However, many candidates lacked the basic knowledge and understanding of the topics assessed through some of these questions and probably made random guesses. The performance of candidates in other 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 circuit diagram. 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, 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. It is emphasised that workings should be shown in the provided spaces when answering calculation questions. Marks are often provided for selection of values and substitution. These marks cannot be awarded if all that is shown is an incorrect answer on the answer line.

Graph work was very good.

The QER question required recall of knowledge. The facility factor of this part was very low. Some responses were very difficult to read, and many spelling and capitalisation errors were seen.

Comments on individual questions/sections

Q.1 All parts were objective type questions requiring recall. Parts (a) and (b) were done well but part (c) less so.

(a) Most candidates gained at least half marks here.

(b) Most candidates scored well in these graph questions.

(i) Most of the points were on major grid intersections and were joined with a series of straight lines. There was some carelessness when drawing lines point to point. A ruler was not always used. The plateau should have been drawn over the 60-grid line. Occasionally there was a clear gap between the drawn line and grid line. Also, some disjointed lines were seen.

(ii) Many correct answers seen. However, through misreading or ignoring the instructions some incorrect values were used leading to a wrong answer. In some cases, showing the two values being subtracted would have given a mark. For example, 50 – 20 = 20 was an error seen. Showing 50 – 20 would have earned a mark even if the answer on the line was 20. Few showed their workings so in these instances an answer of 20 on the line scored zero.

(iii) Most candidates earned full marks.

(c) Many candidates scored full marks. Some candidates failed to add the values or made an arithmetical error in addition. Other candidates could not work out the total mass of each element but had an ecf on the total.

Q.2 This QER required recall of knowledge which always demonstrates a deficiency in the time candidates spend in learning subject content. Many candidates failed to earn a mark. Whenever they did, it was for a smattering of information which varied from candidate to candidate. The mean mark was very low. The not-attempt rate was close to 40%.

Q.3 **(a)** **(i)** Mostly correct answers seen.

(ii) Some candidates completed the calculation correctly. Some substituted correctly but calculated incorrectly. Others used incorrect values from the table.

(iii) Few candidates gained any marks at all. This was surprising. The ions that cause water hardness were not known. Some thought hardness was affected by pH. The not-attempt rate was about 25%.

(b) **(i)** Only a minority of candidates knew the boiling point of water. Answers ranged from 0 to 150°C.

(ii) Hardly any marks were awarded here. Answers just stated a condenser was present. The purpose of the condenser was expected.

(iii) It was very rare to award a mark. One wonders if candidates had actually worked through part (b) or ignored the rest of the question parts and started on this part due to the random answers seen.

Q.4 **(a)** Under half of candidates managed to get both marks. An upper-case A was required for the ammeter symbol. Sometimes the ammeter was correctly placed but the voltmeter was also placed in series. The gap for the voltmeter was often ignored. The symbols were often incorrect because squares were used instead of circles. Random circuit components were also seen.

(b) The variables were correctly identified by a minority of candidates.

(c) Less than half of candidates completed the calculation correctly. Other candidates made rounding errors in the final answer. There were many substitution errors. For example, a temperature was substituted as a current. The candidate even included the unit in the equation and must have thought °C was the unit of current.

(iii) Very few candidates earned a mark here. The mean mark was very low. Pairs of data values from the table were required and answers usually did not include any. The not-attempt rate was about 20%.

(iv) Very few marks were awarded here. Candidates usually included one resistance value in their answer, but both were required. Then the difference between them should have been calculated. This was very rarely done. The mean mark was even lower than in the previous part and the not-attempt rate was about 34%.

Q.5 The attempt rate for all question parts was below 80%. Except for (a)(ii), mean marks were well below 50% and in the case of (c), they were exceptionally low, in single figure percentages.

(a) **(i)** Over half of candidates scored 0. In many instances random numbers appeared on the answer line without any workings shown.

(ii) About half of candidates earned full marks. As in the previous part, random values appeared again without working shown. This part illustrated the problem of not reading the question with care. There were correct calculations seen but for heater 1.

(iii) Few correct answers seen. Incorrect substitutions were common. In one instance, the candidate multiplied a cost by a volume of water.

(iv) Very poor responses were common. Candidates misunderstood the scenario. Candidates believed that the water was held by the heaters but both heaters were in the same tank which held the water. It was surprising how many candidates offered this argument.

(b) Candidates had sparse knowledge of this topic.

(c) **(i) & (iii)** Unfortunately, candidates' knowledge of heat transfer was very limited.

(ii) This was not answered well. Some candidates believed the foam layer trapped fumes. Answers also hinted at keeping heat inside. It was surprising how many candidates believed that heat escape adds to global warming.

APPLIED SCIENCE (DOUBLE 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%). The applied science examination papers cover biology, chemistry and physics topics, set in an applied context.

The degree of difficulty of questions increased throughout the paper, with questions in the common section providing the least 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 numerical information 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 circuit diagram. 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. Some equations were given in the appropriate form in the question part. Others needed rearrangement. However, too many candidates substituted incorrectly into given equations. They did not consider units during the substitution process. Another problematic area was the incorrect rounding of final answers. 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.

Graph work was good.

The QER question required recall of knowledge. The facility factor was very low. Some responses were very difficult to read.

Comments on individual questions/sections

Q.1 Unlike the FT paper, the attempt rate for all question parts was above 87%. Mean marks were close to, or above 50%, except in the case of part (c), where they were exceptionally low.

(a) **(i)** Over half of candidates scored well. The main error was made when converting months to years.

(ii) Most candidates earned full marks. However, this part illustrated the problem of not reading the question with care since there were some correct calculations seen but for heater 1.

(iii) Correct answers seen for about half of candidates. Others selected incorrect values of power including those associated with heater 2.

(iv) A minority of candidates evaluated the claim correctly. Other candidates misunderstood the scenario. They believed that the water was held by the heaters but both heaters were in the same tank which held the water.

(b) About half of candidates had knowledge of this topic.

(c) **(i) & (iii)** Unfortunately, candidates' knowledge of heat transfer was very limited.

(ii) This was not answered well. Some candidates believed the foam layer trapped fumes. Others mentioned the foam could be recycled. Answers also hinted at keeping heat inside. It was surprising how many candidates believed that heat escape adds to global warming.

Q.2 **(a)** Less than half of candidates could give a definition of diffusion.

(b) Over half of candidates failed to earn a mark. Their knowledge of this topic was weak. Answers included all sorts of ideas including chromatography.

(c) Commonly answers just described the diagram by referring to gaseous exchange between the blood and alveolus. Very few answers mentioned a concentration gradient. Over half of candidates failed to earn a mark.

(d) Knowledge of this topic area was very poor.

Q.3 **(a)** Candidates were unable to identify the components that would affect acidity let alone describe how this was due to human activity. As a result, they failed to earn a mark.

(b) Over half of candidates scored zero. They did not know the ions responsible for hard water so could not give an explanation.

(c) **(i)** Very poor answers were seen. The role of the condenser was not well known. It was often referred to as a tube.

(ii) About half of candidates could give some description of the relevant factors but usually to gain 1 mark. Some candidates misunderstood the use of the word plant in this question. They believed it to be a living thing as in a biological context.

Q.4 **(a)** This was very poorly done. The symbol for a thermistor was not known by most candidates, neither was the need for an ammeter and voltmeter. If a voltmeter was present, it was usually connected in series. Most candidates scored zero. All sorts of components were included in the circuit except the required ones. Just over 22% of candidates did not attempt the question.

(b) **(i)** It was pleasing to see some excellent graph work in many instances. However, if the question asks for a suitable line then it does not mean join point to point with a series of straight lines. The suitable line here was clearly a curve. Some candidates added a non-linear scale. They just added the values from the table so they were equally spaced. This prevented these candidates getting any marks since the plots become easier to add and the line was straight.

(ii) The most common answer did not address the decreasing rate. This type of question, when worth 2 marks, always requires a second comment to be included.

(iii) In part I, candidates were expected to add a line to their graph to determine the resistance at 30ºC. If this was not done the first mark was withheld but the remaining marks were available. Even when the first calculation was correct there was often an error in the second part since the conversion of mA into A was not done. This was penalised by the loss of the sixth mark. Candidates need to be mindful of units. Many errors in substitution, rearrangement and incorrect rounding of final answers were seen. For example, the temperature value of 30°C was substituted as a current. One equation was often quoted as current = voltage × resistance.

The recommended order of carrying out calculations is:
- Write down the equation
- Make substitutions
- Rearrange
- Complete the calculation

When candidates do not adopt this style, mistakes are frequently made. Too often the first step shown was an incorrect rearrangement of values which earned no credit. The not-attempt rate was about 15%.

(c) Candidates could not come up with the required modifications. A common answer was to just to place the thermistor in a refrigerator. The not-attempt rate was about 17%.

Q.5 Most candidates failed to earn any credit. Knowledge of this process was very poor. The diagram was intended as a prompt, but it did not help. The mean mark was only 0.6. The not-attempt rate was about 22%.

Q.6 **(a)** **(i)** Mostly incorrect answers seen. The term carbon footprint was misunderstood by many.

(ii) Over half of candidates failed to get anywhere with this calculation. Instead of multiplying the values at the start they were divided. The value 500 made an appearance but this was a distractor. Where there was a final answer it was not always written to 2 significant figures on the answer line.

(iii) Most answers concentrated on the radiation aspect of nuclear power so did not answer the question. The mean mark was very low and not-attempt rate was about 21%.

(iv) It was surprising that very few candidates could give an acceptable answer. Clearly the term carbon neutral was not well understood.

(b) **(i)** This was another term that candidates did not understand. Answers attempted to define potential in a general sense e.g. could cause global warming.

(ii) Most candidates did not attempt a rearrangement and just multiplied both values. When a rearrangement was included, candidates failed to divide powers of 10 correctly.

APPLIED SCIENCE (DOUBLE AWARD)

GCSE

Summer 2024

UNIT 2: 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%). The Applied Science examination papers cover biology, chemistry and physics topics, set in an applied context.

There was an increase in objective style questions this year. Performance in these questions was mixed, some aided recall of knowledge but others did not. 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 objective style question parts were generally well attempted, but not all. This style of questioning made them more accessible to candidates. However, many candidates lacked the basic knowledge and understanding of the topics assessed through some of these questions and probably made random guesses. The performance of candidates in recall questions tended to be 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. One question part required candidates to complete a bar chart. 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 subtractions. Another problematic area was the incorrect rounding of final answers. 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.

The QER question did not require recall of knowledge. However, the mean mark remained in the lower band. Some responses were very difficult to read, and too many spelling and capitalisation errors were seen.

The pre-release was based on the theme of triathlons. There were 25 marks based on this resource, 19 of which were common to both tiers. This year, none of the questions depended on recall. As usual, teachers within centres are free to use the resource to prepare candidates for the examination. It is assumed that teachers take the time to read through the material with candidates, clarifying any queries that arise. The 6-mark question found solely on the FT paper was answered quite well.

Comments on individual questions/sections

Q.1 This question was all based on recall, except for 1 mark. It was heavily scaffolded. As a result, parts (a) and (c) were answered well, however in part (a), mushrooms was a popular answer for one of the kingdoms. Part (b) was poor. Some candidates inserted letters into the sequence that had already been placed there. More care was required in reading the information.

Q.2 This objective style question depended on recall. Performance was weak especially in part (b). It is always a surprise when about 10% of candidates do not even attempt to underline a couple of words.

Q.3 This question was based on a specified practical. Answers to part (a) required knowledge of the method and it was answered poorly. There was also a not-attempt rate of about 21%. Part (b) was based on some data and required candidates to complete a bar chart. A surprising number of candidates did not attempt this. It is possible that the question at the top of the page was just ignored, and candidates moved on to parts (ii) and (iii). Many candidates ignored the invertebrate chart and added up the number found in each location to decide which was the cleanest.

Q.4 **(a)** Answered well although a sizeable minority of candidates believe that the Liquid State is one theory of the Universe.

(b) It is still common to see sound included as an example of electromagnetic waves. The not-attempt rate was about 26%.

(c) Rare to see a correct answer.

(d) Some knowledge of gas and rocky planets was required here. It was unclear whether the questions were not read with care or candidates did not know which planets were rocky and which were gas giants. Either way, responses were very poor.

(e) A minority selected the correctly shaped orbit.

Q.5 The majority of candidates scored over half marks with part (a) answered more successfully than (b). Some candidates substituted correctly but final answers were incorrect. Without workings shown, they would have scored zero and this is far too common an occurrence. Other candidates selected incorrect data from the table.

Q.6 No comments to highlight.

Q.7 This objective style question included clues as to the methods used for different treatments/diagnoses. Despite this, the treatments were not well known since most candidates scored less than half marks and 7% did not attempt to place any ticks in the table. The instruction to place one tick in each row was often ignored.

Q.8 **(a)** This question required underlining a word in brackets, but most attempts must have been guesses due to the low mean mark. Knowledge of this topic, even with prompts, was poor. Just over 11% failed to attempt any of the three parts.

(b) This QER was based on a graph showing immune response over a 10-week period following 2 vaccinations. It did not require detailed knowledge. Responses were mainly poor with the mean mark in the lower band. Significant omissions occurred too frequently. These include failing to refer to antibodies, vaccinations, and not including data even though this was asked by the question. The not-attempt rate was about 15%.

Q.9 This was the FT only question based on the pre-release. The mean of half marks demonstrates that candidates interacted quite well with the article. It was disappointing that marks were lost for incorrect subtraction.

Q.10 This question was common to both tiers. It was entirely based on the pre-release. All question parts directed candidates to the relevant section of the article. They all required interpretation of data. The facility factors of all parts were low. Not-attempt rates varied from about 20% to 45%. Some calculations were required, and in all instances the equations were provided in the form to be used.Questions such as (a), (b) and (h), asked candidates to evaluate data to reach a conclusion. Candidates were asked to include data but too frequently failed to do so. They also did not consider both sides of the argument. In parts (c), (f) and (g), standard calculations of BMI, mean speed and acceleration were required. These were not done well. Candidates failed to convert from cm to m in the BMI calculation. They also ignored squaring the height. Candidates made addition errors when working out the distance travelled during an Ironman triathlon. They also quoted a speed rather than change in speed when calculating acceleration. Too many candidates persist in just writing their answer on the line without showing any workings. This is a dangerous strategy since no marks can be awarded in the case of incorrect answers. Also, marks were lost for incorrect rounding at the final answer stage. In all parts, there was evidence of candidates selecting data incorrectly. Questions must be read with more care.

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UNIT 2: 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%). The Applied Science examination papers cover biology, chemistry and physics topics, set in an applied context.

The paper was of comparable demand 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, with questions in the common section providing the least challenge.

Recall questions that required descriptions and/or explanations tended to be less well answered than those requiring very little knowledge. This is nothing new and has been commented on in exam reports for several series. Where candidates demonstrated some knowledge and understanding, many answers were vague or confused and sometimes did not relate exactly to the question asked.

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. Some question parts required candidates to add to a graph or complete a diagram. As a result, they 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 assessed mathematical skills. Equations were given in the appropriate form in some question parts. However, too many candidates substituted incorrectly into given equations. They did not consider units during the substitution process. Errors were seen in simple additions, subtractions, calculating a mean, and handling percentages. Another problematic area was incorrect rounding of final answers. 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.

The quality of graph work was inconsistent. Candidates were expected to add a scale to the x-axis in one question. Some candidates were unable to produce a linear scale from the tabulated data. They just added the values to the axis, equally spaced in the order presented to them. There remains a group of candidates who interpret the axes correctly to plot early points successfully, but, whether due to lack of concentration or other reasons, fail to achieve this for later plots.

The QER question required recall of knowledge of a specified practical and the mean was a lower band mark.

The pre-release was based on the theme of triathlons. There were 25 marks based on this resource, 19 of which were common to both tiers of papers. This year, none of the questions depended on recall. As usual, teachers within centres were free to use the resource to prepare candidates for the examination. It is assumed that teachers take the time to read through the material with candidates, clarifying any queries that arise.

Comments on individual questions/sections

Q.1 This question was common to both tiers. It was entirely based on the pre-release. All question parts directed candidates to the relevant section of the article. They all required interpretation of data. The facility factors of all parts were much higher than on FT, with most ranging from about 40% to almost 70%. Attempt rates were high. Some calculations were required, and in all instances the equations were provided in the form to be used. Questions such as (a), (b) and (h), asked candidates to evaluate data to reach a conclusion. Candidates were asked to include data but frequently failed to do so. They also did not consider both sides of the argument. In part (e), most candidates combined interpretation of the graph with data from the resource booklet to answer the question successfully. In parts (c), (f) and (g), standard calculations of BMI, mean speed and acceleration were required. Performance was varied. Some candidates failed to convert from cm to m in the BMI calculation. They also ignored squaring the height. Candidates made addition errors when working out the distance travelled during an Ironman triathlon. They also quoted a speed rather than change in speed when calculating acceleration. Too many candidates persist in just writing their answer on the answer line without showing any workings. This is a dangerous strategy since no marks can be awarded in the case of incorrect answers. Also, marks were lost for incorrect rounding at the final answer stage. In all parts, there was some evidence of candidates selecting data incorrectly. Questions must be read with more care.

Q.2 This was the HT only question based on the pre-release. The low mean indicates deficiencies in numeracy skills. Candidates made errors in calculating a mean value and in determining the pattern in, and continuing a sequence of numbers.

Q.3 This was a recall question based on knowledge of classification of living things. In part (a), the majority of candidates could name one kingdom, but many repeated the name of one already given in the question. Part (b) was poorly answered. A minority of candidates could complete the levels of classification. The not-attempt rate of about 36% was the highest on the paper. Part (c) was answered correctly by most candidates.

Q.4 Parts (a) and (b) were well answered. Part (c) was more of a hurdle for candidates. Only a minority arrived at the correct answer. Errors included not using the answer from part (b), irrelevant numbers were used in the calculation, and mistakes were made when scaling up to 20 g of cheese and 15 g of biscuits.

Q.5 **(a)** The meaning of the terms used in drug development were not well known.

(b) This was one of the least well answered questions on the paper with a facility factor of 8.9%. Only a small minority of candidates could state a positive/negative effect of regularly taking aspirin.

(c) A minority of candidates were able to calculate 20.7% of 100 000. About half just divided 100 000 by 20.7.

Q.6 **(a)** **(i)** Knowledge of the production of absorption spectra was very poor. Common misconceptions were;

- Stars are crossed by dark lines
- Radiation absorbs light
- Light absorbs gases

(ii) The majority of candidates were able to interpret the absorption spectra to gain both marks.

(b) Most candidates earned both marks for adding a scale and plotting the points correctly. A minority of candidates added a non-linear scale. The numbers from the table were added in order and equally spaced. This is quite a common error where the data is presented in a similar way. This has been mentioned in previous reports. It was very difficult on occasions to judge the centre of a candidates' plotted points. Candidates need to draw just a small, simple cross rather than other styles. The plot for Jupiter was incorrectly identified as the anomaly by a substantial number of candidates. Others did not attempt to identify the anomaly. A minority of candidates were able to draw a smooth curve through the points. This is a skill that needs practicing. Others ignored the instruction and joined the points with a series of straight lines. A minority of candidates were able to determine the distance from the Sun at which a planet would have a mean temperature of 0°C. When adding intercept lines to a graph, they should be thin and drawn with a ruler. Some candidates did not add an intercept line down to the x-axis and failed to read the appropriate value from the axis.

(c) It's doubtful that this part of the paper was read carefully enough. The not-attempt rate here rose to about 16%. Other candidates noticed the Sun and drew the solar system around it. Very few drew an acceptable orbit of a comet.

Q.7 **(a)** This QER required knowledge of a specified practical. The mean mark was in the lower band. Significant detail was usually omitted. Some methods would not be recommended e.g. placing indicator species into the stream and see if they survive. It was pleasing to see higher band answers, but these were few and far between. The not-attempt rate was about 13%.

(b) Responses were much better. Many candidates used the chart to compare the water qualities correctly. Others thought the quality of water was determined by the number of invertebrates found in the samples, not the type. Some candidates did not use the water-type descriptors from the information provided in the chart.

Q.8 **(a)** This topic was not well known or understood. There was confusion with the ozone layer and even greenhouses. This was the least well answered question on the paper.

(b) Most candidates were able to earn a mark here. These effects were quite well known.

(c) Most candidates earned both marks here.

Q.9 **(a)** Candidates were presented with a graph to interpret. This type of question often appears where a description of one variable against another is required. About a quarter of candidates failed to get any marks because they did not make much reference to the graph and wrote generally about things they may have heard about vaccines in the news or social media. Others failed to make a comparison.

(b) This topic was not well known. The facility factor was low and about 11% of candidates did not attempt the question. Most candidates failed to earn any credit. They generally spoke about the vaccine giving people the illness.

APPLIED SCIENCE (DOUBLE AWARD)

GCSE

Summer 2024

UNIT 3: 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 biology, chemistry and physics topics, in an applied context.

The demand of the early questions was less than in previous series due to an increase in objective style questions. 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 early objective style question parts were generally well attempted. This style of questioning, especially those requiring recall of knowledge, made them more accessible to candidates. However, many candidates lacked the basic knowledge and understanding of the topics assessed through these questions and probably made random guesses. There were also those candidates who, through failing to read the question properly, did not follow instructions so selected more answers than required or used words/numbers of their own choosing rather than those given in a box.

Recall questions that required descriptions and/or explanations tended to be poorly answered. This is nothing new and has been commented on in exam reports for several series. This was particularly evident in questions relating to practical work. For example, candidates did not know the meaning of the term reproducibility. In some of these question parts, candidates were asked to include data in their answer. Failure to do so often resulted in no marks being awarded. Where candidates demonstrated some knowledge and understanding, many answers were vague or confused and sometimes did not relate exactly to the question asked.

Some questions required candidates, for example, to add a line to a graph or complete a diagram, and as a result did not have dotted lines to write an answer on. Too frequently, these question parts were not attempted. This was despite a command word being printed in bold. It appears candidates only expect to see a question accompanied by these dotted lines and if there are none they move on to the next part or page. This has been commented on in previous reports.

Questions that assessed mathematical skills were generally well attempted with some candidates gaining full marks. 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. It is also expected that candidates can calculate a mean or percentage without being given an equation. Too many candidates failed to successfully carry out these calculations. Errors were seen in a simple subtraction. Another problematic area was the incorrect rounding of final answers. 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.

The quality of graph work was inconsistent. Candidates were expected to add a scale to the x-axis in one question. A sizeable minority were unable to produce a linear scale from the tabulated data. They just added the values to the axis, equally spaced in the order presented to them. The majority of candidates were able to successfully plot points onto the grid but few were able to add a best fit curve. There remains a group of candidates who interpret the axes correctly to plot early points successfully, but, whether due to lack of concentration or other reasons, fail to achieve this for later plots. Understanding of the term direct proportionality was clearly poor.

It was pleasing to see top band answers in the QER question. This was an improvement on previous series. However, some responses were very difficult to read, and too many spelling and capitalisation errors were seen.

Comments on individual questions/sections

Q.1 This was an objective style question based on recall. It was answered well by most candidates.

Q.2 Parts (a) to (c) were objective style questions but based on all three assessment objectives.

(a) Only about half of candidates successfully selected the correct gas produced during fermentation.

(b) The stages in beer making were completed correctly by about half of candidates. The stages A, F and E were already given in the appropriate order. It was surprising that when filling in the gaps, one or more of these given stages were inserted in a blank space by some candidates.

(c) These question parts did not require any recall of knowledge and as a result were well answered by a greater percentage of candidates. Most candidates were able to interpret the graph then select the correct value from those given in the box. Part (iv) was the least well answered but still the majority of candidates earned the mark. Finding the difference between two points on the graph proved too difficult for the remainder. Some candidates ignored the instruction to use the numbers in the box to answer the questions and so could not get any marks whenever this occurred.

(d) This was the first example of a calculation based on a given equation. Over half of candidates failed to earn any marks, with the rest earning 1 or 2 marks. Errors made included:

- inability to carry out the subtraction 50 – 20 correctly
- Failure to follow instructions by not using their answer from (c)(iv)
- Incorrectly substituting into the equation
- Answers arising from an ecf not being rounded correctly.

Q.3 **(a)** No areas to highlight.

(b) A significant minority of candidates failed to answer the question, just over 28%. The instruction to add a line to the graph was ignored. This was despite the word 'Draw' being in bold print. Candidates must carefully read all sentences appearing on a page.

(c) **(i)** Mostly poor responses were seen in this question part. Candidates appeared to have more success in answering this type of question in the practical assessments.

(ii) **I** This question required evaluation of given data. Less than half of candidates gained credit. Where candidates failed to include data then no credit could be given. Some answers were seen where the stem of the question was just repeated. Those candidates who earned a mark often failed to consider all the data. They only considered the pair of data that agreed with the claim. It is important that candidates take time to consider all possibilities arising from the question.

II Mostly correct predictions made.

(iii) No areas to highlight.

Q.4 **(a)** **(i)** Performance was poor here. About half of candidates failed to earn a mark. About a third of the remainder only got one mark. Both these groups of candidates thought there would be more bacterial growth at lower temperatures.

(ii) The meaning of the term reproducibility was not known by the vast majority of candidates. A mark was rarely awarded.

(b) The four parts were short answer questions which required recall of knowledge. All parts were very poorly answered with very few marks awarded.

(c) **(i)** Candidates interacted well with the diagram with about two thirds gaining 2 or 3 marks. The most common reason for losing a mark was making an error in calculating the mean of 4 numbers.

(ii) Few candidates understood the benefits of increasing the sample size.

Q.5 **(a)** Only about a third of candidates earned this mark. Common errors were adding 2 electrons but not in the overlap region and adding more than 2 electrons.

(b) Very poorly answered. Candidates were unable to use the information from the given equation to decide which bonds were broken in the reactants and which were formed in the products. The most common answer was to add all the energy values in both parts of the question.

(c) This part required selecting words from a box to complete sentences about an endothermic reaction. This resulted in many candidates scoring well. However, it is doubtful that candidates re-read the sentences once they had inserted their chosen words. A sizeable number of candidates made an error by inserting increase after the word temperature. A few candidates decided to use words not given in the box.

Q.6 This QER question was based on a titration curve and only required limited knowledge. Responses covered all bands of marks. It was pleasing to see some very good answers that achieved at least 5 marks. Middle band answers omitted some detail e.g. no statement about either solution A or B. The majority of answers obtained marks in the lower band. These gave limited detail and often confused solutions A and B. Spelling, punctuation and lack of capital letters at the start of sentences were still present in many responses. About 23% of candidates did not attempt to answer this question.

Q.7 **(a)** Some candidates added a non-uniform scale by omitting 10 and 20 and proceeding immediately to 30 at the first 2 cm mark. Others failed to extend their curve back to the origin.

(b) The most common answer was in agreement because depression increases with length. The term proportional was not well understood. The not attempt rate was about 27%.

(c) Candidates were often penalised for incorrect substitution. This may have been due to carelessness in reading information or an inability to match units with a physical quantity. The weight was given in the initial stem of the question and included on the diagram. For example, a length was substituted for a weight, and a weight substituted for depression.

Q.8 **(a)** Very few candidates were able to label both parts of the diagram or state two functions of stomata. This demonstrated a lack of knowledge of this topic.

(b) There was an instruction above part (i) to use data from the graph to answer the questions that followed. This was not the case on many occasions. Another error was not to give an answer related to the nitrates line because candidates chose one of the other nutrient lines instead. In part (ii), few candidates achieved full marks. Others made errors in calculating a percentage or failed to obtain the correct value of kg/hectare from the graph which was required for part II.

APPLIED SCIENCE (DOUBLE AWARD)

GCSE

Summer 2024

UNIT 3: 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 in an applied context.

The paper was of comparable demand 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, with questions in the common section providing the least challenge.

Questions that required descriptions and/or explanations tended to be less well answered than those requiring very little knowledge. This is nothing new and has been commented on in exam reports for several series. This was particularly evident in questions relating to practical work. For example, candidates did not know the meaning of the term proportional. In some of these question parts, candidates were asked to include data or use the graph in their answers. Failure to do so often resulted in no marks being awarded. Where candidates demonstrated some knowledge and understanding, many answers were vague or confused and sometimes did not relate exactly to the question asked.

Questions that assessed mathematical skills where equations were given in the appropriate form were generally well attempted with some candidates gaining full marks. However, too many candidates substituted incorrectly into given equations. They did not consider units during the substitution process. Candidates had less success attempting questions requiring numeracy skills where an equation was not provided. It is expected that candidates are able to perform a calculation involving percentages. Errors were seen in simple arithmetic. Another problematic area was the incorrect rounding of final answers. 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.

The quality of graph work was inconsistent. Candidates were expected to add a scale to the x-axis in one question. Some candidates were unable to produce a linear scale from the tabulated data. They just added the values to the axis, equally spaced in the order presented to them. The majority of candidates were able to successfully plot points onto the grid and the majority were able to add a best-fit curve. There remains a group of candidates who interpret the axes correctly to plot early points successfully, but, whether due to lack of concentration or other reasons, failed to achieve this for later plots. Understanding of the term direct proportionality was clearly poor.

The QER question required knowledge of nuclear fusion and fission. Most candidates ignored the requirement to compare the two types of reaction. The mean mark was in the lower band.

Comments on individual questions/sections

Q.1 **(a)** The graph was completed well by the majority of candidates. However, some candidates added a non-uniform scale by omitting 10 and 20 and proceeding immediately to 30 at the first 2 cm mark. Others failed to extend their curve back to the origin.

(b) The most common answer was in agreement, because depression increases with length. The term proportional was not well understood.

(c) This calculation was completed correctly in most instances. Some candidates were penalised for incorrect substitution. This may have been due to carelessness in reading information or an inability to match units with a physical quantity. The weight was given in the initial stem of the question and included on the diagram. For example, a length was substituted for a weight, and a weight substituted for depression.

Q.2 **(a)** Few candidates were able to label both parts of the diagram or state two functions of stomata. This demonstrated a lack of knowledge of this topic.

(b) Just over half of candidates were able to interpret the graph to give a correct explanation. There was an instruction above part (i) to use data from the graph to answer the questions that followed. This was not the case in a minority of cases. No data resulted in a mark of zero. Another error was not to give an answer related to the nitrates line because candidates chose one of the other nutrient lines instead. In part (ii), about a half of candidates achieved full marks. Others made errors in calculating a percentage or failed to obtain the correct value of kg/hectare from the graph which was required for part II.

Q.3 **(a)** This question part was based on chemical tests. It required recall of knowledge and as a result was poorly answered. It was common to award marks of zero.

(b) This calculation was much better answered than the recall question in part (a). It was good to award full marks. However, this was to a minority of candidates. Some candidates made substitution errors when using the given equation. Still too many candidates just provide a value on the answer line with no workings shown. If these answers are incorrect then the mark is zero.

Q.4 **(a)** Few candidates were able to write down the fermentation equation demonstrating a lack of knowledge by most.

(b) It was rare to see an acceptable statement giving the meaning of genetically modified. In part (ii), candidates had difficulty in interpreting the graph so as a result they failed to gain credit. Many did not include any data values from the graph so they were awarded zero.

(c) This part required some knowledge and as a result was answered poorly.

(d) The stages involved in the fermentation process were poorly known. In a significant number of instances, candidates added yeast and then went on to boil the mixture. They did not appear to know that this would kill the yeast cells so no fermentation process could occur.

Q.5 **(a)** Candidates were required to interpret the given equation and table of bond energy values to calculate the energy required to break all the bonds in an ethanol molecule. Using this answer, they needed to calculate the energy needed to break an O=O bond. Some excellent responses were seen which gained full marks, but these were few and far between. It was far more common to see errors in counting the numbers of the bonds involved, e.g. there were five H-C bonds, but quite often this was not the number used in the workings. Some candidates made errors in addition and subtraction. Some candidates failed to arrive at the correct answer but earned partial credit for their workings. Too many instances of incorrect answers without workings were seen which resulted in zero marks.

(b) From the data given in the question, candidates should have realised that an exothermic reaction was involved hence the need for a cooling system. It was very rare to see a suitable explanation.

Q.6 **(a)** **(i)** This was very poorly done. About 21% of candidates did not attempt it. They were unable to describe the bonding and the diagrams, if drawn, were not close to the expected version.

(ii) was not answered any better. Mostly very poor answers were seen in parts (iii) and (iv). Candidates' knowledge of this area of the specification was very limited.

(b) Most candidates scored well in this question part. They used the data to come up with very good explanations. Unlike part (a), this part did not require in depth knowledge. It also had a higher attempt rate than any of the parts in (a).

Q.7 **(a)** This QER required knowledge of nuclear fission and fusion. Sadly, this was lacking. As a result, the mean mark was in the lower band range. Some high scoring responses were seen but these were rare. The non-attempt rate was about 13%.

(b) Well answered by most candidates.

Q.8 **(a)** About half of candidates earned full marks here. They read the graph correctly, clearly understood the question and scaled up correctly. Others failed to act on the information about every confirmed case matching with 2 unconfirmed cases. Another group did not know how to scale up from 100 000 to 3 million.

(b) **(i)** Very poorly answered. The first mistake was not to include the power of 10 when taking a reading from the graph. Candidates need to take care when looking at the labelling of axes. The majority of candidates realised that 1 hour is made up of three 20-minute periods. However, instead of doubling 3 times, candidates simply multiplied by 3. It was a joy to see a few correct responses.

(ii) This was very poorly answered. Candidates did not understand how to proceed. All that was required was to multiply the answer from part (i)I by 7 and compare the result with 120 000, then finally make a concluding remark. The non-attempt rate was about 25%.

APPLIED SCIENCE (DOUBLE AWARD)

GCSE

Summer 2024

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: World of life; Scientific Detection; and Health, Fitness and Sport. Pack B tested candidates' ability within the topics of: Building electric circuits; Obtaining clean water; and Obtaining the materials for respiration.

Pack B was much more popular than Pack A, although candidates appeared to 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 fewer candidates left questions blank.

Comments on individual questions/sections

Activity 1
Task A Planning

On average, candidates scored over 50% on this task. Some candidates were still confused by the terms: independent, dependent and controlled variables. The new style of question that required candidates to choose from a list, allowed more candidates to correctly select the independent and dependent variables, particularly as these were identifiable from the Introduction section. Some candidates in both packs still had problems identifying the controlled variables. Many candidates from Pack A failed to draw a labelled diagram of the apparatus, and effectively only drew a list of apparatus, without showing how the length of the leaf would be measured. 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. 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 repeats and the correct range/interval 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 ruler (Pack A) or ammeter (Pack B). The most common mistakes for those candidates attempting Pack A were to miscount the number of leaves measured (generally measuring less than 30 leaves) and failing to indicate the units used to measure the leaves. A significant number of candidates were confused about how to arrange the leaves into single centimetre length categories. 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. 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 are still struggling 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

Candidates, on average, scored just over 60% of the available marks for this section. The most common difficulties involved plotting the graphs/charts 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 places as the (primary) data. This was an issue for a significant minority of candidates for both Pack A and 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. The bar-chart in Pack A proved to be more successful. Centres should continue to give candidates lots of practice on this skill and give plenty of opportunities to plot both types of graph/chart. It was pleasing to see that most candidates were able to describe the pattern in their results, although the relatively random nature of number of leaf spikes, in Pack A, gave much more of a challenge. Both Packs required candidates to extract information from their graph/chart. Most candidates attempting Pack A were able to identify the 'best' leaf length as the one with the highest mean number of spikes. However, they then struggled to express why this would be best by referring back to the client brief in the introduction. Most candidates attempting Pack B 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 about 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 need 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 were still referring to all their data being similar, when they should be focusing on the similarity of their repeated data values. Pack A asked candidates to assess the variation in the number of spikes for each leaf length. Many candidates obviously misread the question and simply re-stated the pattern in their results, rather than talking about the range of the number of spikes for each leaf length. 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 60% of the available marks for this section. Most candidates were able to complete the identification flow chart in Pack A, but then went on to struggle with identifying the correct chemicals in the dish, with a significant minority of candidates leaving out reference to the cation, sodium. Most candidates struggled to suggest a clear way to ensure that the Petri dish lids did not get mixed up and did not describe a way to link each Petri dish to its lid. Many candidates in Pack A were unable to calculate the two missing means, with the most common mistake being candidates' inability to round their mean numbers correctly. Although most candidates attempting Pack A were able to identify the sulfate test as the most difficult to perform safely and correctly, the majority were unable to suggest suitable correct reasons for this. 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 found evaluations very challenging, scoring just over 25% of the marks 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 the anions in each compound. A significant minority of candidates were unable to suggest a reason why they did not have to identify the cations, but most were able to suggest an improvement to improve the students' ability to perform the tests safely, with many correctly identifying wearing goggles as a correct answer. A significant number of candidates were unable to explain whether the test results were reproducible across all the classes, suggesting most candidates did not know the meaning of the term 'reproducibility'. This then caused issues for candidates when asked to suggest (non-safety related) reasons for this. For Pack B, when asked about the suitability of the experiment, many candidates wrote about the method being easy to follow. Candidates need either to examine the pattern in the data or to give a comment about the uncertainty of the data. Candidates found it quite hard to explain why 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 changes in the mass of solids.

Activity 3

Candidates continue to find constructing a risk assessment difficult. Although candidates scored better than on evaluation sections, they on average only gained 35% of the marks for the Risk Assessment activity. 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. bromine water is an irritant; 0.15 mol/dm^3 sodium hydroxide is an irritant) – the specific nature is lifted straight off the Student Safety Sheet. Please note, candidates should always state the concentration of solutions if given, as this determines the level of the nature of the hazard.
- Risks must have an injury and an action (e.g. hot water could scald or burn the skin/eyes when putting the test-tube in or removing from the water bath). A significant minority of candidates correctly identified the relevant injuries but did not state the action. Please keep candidates aware that some identified 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 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, or perform experiments, in a fume cupboard).

APPLIED SCIENCE (DOUBLE AWARD)

GCSE

Summer 2024

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: World of life; Scientific Detection; and Health, Fitness and Sport. Pack B tested candidates' ability within the topics of: Building electric circuits; Obtaining clean water; and Obtaining the materials for respiration.

Pack B was much more popular than Pack A, although candidates appeared to 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 fewer candidates left questions blank.

Comments on individual questions/sections

Activity 1

Task A Planning

On average, candidates scored over 55% on this Task. Some candidates were still confused by the terms: independent; dependent and controlled variables. As with previous years, a significant minority of Higher Tier candidates neglected to state any of the variables. Centres should point out to candidates that most of these are generally identifiable from the Introduction section. Some candidates in both packs still had problems identifying the controlled variables. Many candidates from Pack A failed to draw a labelled diagram of the apparatus, and effectively only drew a list of apparatus, without showing how the length of the leaf would be measured. 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 continued 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 section to the Activity. Centres need to remind their candidates to check that their methods include repeats and the correct range/interval 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 ruler (Pack A) or ammeter (Pack B). The most common mistakes for those candidates attempting Pack A were to miscount the number of leaves measured (generally measuring less than 30 leaves) and failing to indicate the units used to measure the leaves. A significant number of candidates were confused about how to arrange the leaves into single centimetre length categories. 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. Some candidates still need practice in listing all the units in table headings 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 60% of the available marks for this section. The most common difficulties involved plotting the graphs/charts and performing calculations. Candidates needed to be more critical of their data and to check for obvious anomalies. These should be identified and removed from any mean calculations. Candidates should practise 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 both Pack A and 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. The bar-chart in Pack A proved tricky to many candidates, with a significant number of candidates drawing a line graph, even though the data was categoric. Higher Tier candidates needed to be able to select the correct form of graph for their data. It was pleasing to see that most candidates were able to describe the pattern in their results, although the relatively random nature of number of leaf spikes in Pack A, gave much more of a challenge. Both Packs required candidates to extract information from their graph/chart. Most candidates attempting Pack A were able to identify the 'best' leaf length as the one with the highest mean number of spikes. However, they then struggled to justify why this would be best by referring back to the client brief in the introduction. Most candidates attempting Pack B were able to read a value from their graph correctly and were able to draw the second line for resistor B correctly. A significant minority of candidates struggled with the higher tier calculations, with many of the Pack A candidates unable to identify how to calculate the number of leaves of their recommended length. Although most candidates attempting Pack B were able to access the calculations, a significant minority were unable to write their answers to the appropriate number of significant figures. Pack A candidates then struggled to explain why they would recommend holly or berberis, as most did not reference the deterrence factor in their answer. Candidates doing Pack B were more successful in selecting and justifying the resistor that 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 about 40% 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 either to examine the pattern in the data or to 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 just referred to all their data being similar, when they should be focusing on the similarity of their repeated data values. Pack A asked candidates to assess the variation in the number of spikes for each leaf length. Many candidates obviously misread the question and simply re-stated the pattern in their results, rather than talking about the range of the number of spikes for each leaf length.

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 scored, on average, just over 60% of the available marks for this section.

Most candidates were able to complete the identification flow chart in Pack A, but a minority then went on to struggle with producing their own flow chart to identify the cations, with the most common error being the omission of the stage to clean the flame probe in concentrated hydrochloric acid. Most candidates were able to identify the correct chemicals in the dishes, but a small minority of candidates left out reference to the cations, sodium or potassium, or failed to identify that the Petri dishes in Set 4 contained two compounds each. A small minority of candidates in Pack A were unable to round the incorrectly recorded value to the appropriate number of significant figures. Although most candidates attempting Pack A were able to identify and explain which class performed best, they struggled to identify and explain why the sulfate test was the most difficult to perform safely and correctly.

A significant number of Pack A candidates were unable to explain why concentrated hydrochloric acid was used to clean the flame probes rather than dilute hydrochloric acid. A significant minority of 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. Most candidates found describing the relationship between mass of sediment and salinity very challenging, with a significant number only describing the relationships in relation to distance from the sea. Many candidates 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 found evaluations very challenging, only scoring 40% of the marks 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 identify the anions in each compound.

A significant minority of candidates were unable to suggest a reason why they did not have to identify the cations, but most were able to suggest an improvement to improve the students' ability to perform the tests safely, with many correctly identifying wearing goggles as a correct answer. A significant number of candidates were unable to explain whether the test results were reproducible across all the classes, suggesting that most candidates did not know the meaning of the term 'reproducibility'. This then caused issues for candidates when asked to suggest (non-safety related) reasons for this. 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 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.

Activity 3

Candidates continue to find constructing a risk assessment difficult, only gaining just over 25% of the mark for the Risk Assessment activity. 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. bromine water is an irritant; 0.15 mol/dm^3 sodium hydroxide is an irritant) – the specific nature is lifted straight off the Student Safety Sheet. Please note, candidates should always state the concentration of solutions if given, as this determines the level of the nature of the hazard.
- Risks must have an injury and an action (e.g. hot water could scald or burn the skin/eyes when putting the test-tube in or removing from the water bath). A significant minority of candidates correctly identified the relevant injuries but did not state the action. Please keep candidates aware that some identified 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 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, or perform experiments, in a fume cupboard).

APPLIED SCIENCE (DOUBLE AWARD)

GCSE

Summer 2024

UNIT 5: PRACTICAL ASSESSMENT

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.

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