# GCSE EXAMINERS' REPORTS

APPLIED SCIENCE (Single Award)
**GCSE**

**SUMMER 2023**

## Introduction

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

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

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

## Further support

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**Subject Officer's Executive Summary**

The changes to the foundation tier papers to make the marks more accessible at the start (the first 25% of marks) helped to increase the means this year. Changes made were short answers, graph plotting, simple calculations, fill in the gaps from a choice of words etc.

In all units however, there were many comments on the low attempt rate for questions on both tiers, including very low demand questions.

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

Maths skills were variable. Single stage calculations were managed much better than multi-stage calculations, and converting units was problematic. However, many candidates struggled with simple substitutions. Graph plotting was also noted as an issue with many graphs not attempted.

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

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

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

| Areas for improvement | Classroom resources | Brief description of resource |
|---|---|---|
| **Unit 2 - blood** | **HTTPS://RESOURCE.DOWNLOAD.WJEC.CO.UK/VTC/2020-21/EL20-21_8-27/SINGLE%20AWARD/ENGLISH/EXERCISE_AND_FITNESS_IN_HUMANS.PDF**<br><br>HTTPS://RESOURCES.WJEC.CO.UK/PAGES/RESOURCESINGLE.ASPX?RIID=4065 | Knowledge organiser<br><br>Blended learning |
| **Unit 2 – food labels** | HTTPS://RESOURCE.DOWNLOAD.WJEC.CO.UK/VTC/2020-21/EL20-21_8-27/SINGLE%20AWARD/ENGLISH/FACTORS_AFFECTING_HUMAN_HEALTH.PDF | Knowledge organiser |

| | | |
|---|---|---|
| | HTTPS://RESOURCES.WJEC.CO.UK/PAGES/RESOURCESINGLE.ASPX?RIID=4021 | Blended learning |
| **Unit 2 – genes and inheritance** | HTTPS://RESOURCE.DOWNLOAD.WJEC.CO.UK/VTC/2020-21/EL20-21_8-27/SINGLE%20AWARD/ENGLISH/FACTORS_AFFECTING_HUMAN_HEALTH.PDF<br><br>HTTPS://RESOURCES.WJEC.CO.UK/PAGES/RESOURCESINGLE.ASPX?RIID=4021 | Knowledge organiser<br><br>Blended learning |
| **Unit 2 – imaging methods** | HTTPS://RESOURCE.DOWNLOAD.WJEC.CO.UK/VTC/2020-21/EL20-21_8-27/SINGLE%20AWARD/ENGLISH/DIAGNOSIS_AND_TREATMENT.PDF<br><br>HTTPS://RESOURCES.WJEC.CO.UK/PAGES/RESOURCESINGLE.ASPX?RIID=4011 | Knowledge organiser<br><br>Blended learning |
| **Unit 3 – task based assessment** | HTTPS://RESOURCES.WJEC.CO.UK/PAGES/RESOURCESINGLE.ASPX?RIID=3354 | Walkthrough of past assessment |

**APPLIED SCIENCE (SINGLE AWARD)**

**GCSE**

**Summer 2023**

**UNIT 2 FOUNDATION TIER**

## Overview of the Unit

This paper is generally sat by year 11 candidates and covers all assessment objectives.

This unit tested the following topics: Factors affecting human health, diagnosis and treatment, fighting disease, exercise and fitness in humans, controlling chemical reactions and controlling nuclear reactions.

There were approximately 1810 entries for this tier paper. About 1610 of these entries were through the medium of English and 200 through Welsh. On the English scripts, not a single question had a 100% attempt rate. On the Welsh scripts there was one question part (qu2b(ii)) with 100% attempt rate. Most candidates appeared to be appropriately entered for this tier and seemed to have the same spread of abilities as candidates from previous series. The candidates generally found the questions increasingly difficult as the demand increased through the paper. This was also reflected in the increasing proportion of candidates not attempting parts of a question.

Question 8 and 9 were common to the Higher Tier paper.

Generally, candidates had difficulty with the following:

- Answering questions that involved recalling knowledge.
- Giving reasons and explanations – candidates preferred just to re-state information given in the stem of the question.
- Understanding what a controlled variable is and using the correct scientific words when describing quantities.

Not all candidates showed their working or substitution into equations which resulted in them gaining zero marks if the answer was incorrect.

## Comments on individual questions/sections

**Q.1** All parts of this question involved either ticking the correct answer or selecting from given words. Therefore, the attempt rate was very high. All parts tested recall, with part (c) being the most successful.

**Q.2** This question was well attempted apart from part b(i) where only 81% of candidates attempted to name the joint.

**(a)** This part was about imaging methods. Candidates were generally able to name another imaging method but were less comfortable with selecting the description of ultrasound and giving advantages of MRI.

**(b)** Again a recall question, with only about a quarter of those who answered knowing that the knee was a hinge joint. Nearly all candidates attempted to put ticks in the table about how the muscles move the leg, with the majority scoring two or more marks out of three.

**Q.3** **(a)** Approximately 80% of candidates attempted this part with the majority giving the correct answer of chemotherapy. 'Antibiotics' was commonly given as an incorrect answer.

**(b)** Candidates were given information about radioactive isotopes in this part and were required to analyse the information. Part (i) I was not answered well as the majority of candidates stated that 'cobalt had a half-life of 5 years' without giving the reason why this was a problem. In part (i) II a small minority of candidates answered correctly, however most opted for thalium-201 as the next shortest half-life after cobalt-60.

Part (ii) was also answered poorly with most candidates re-stating from the stem of the question that it had a 'short half-life' or 'because it is gamma' and not giving an explanation to why these allow the isotope to be used. Part (iii) I was attempted by approximately 80% of candidates, but many just gave a wrong answer on the answer line with no working shown. Common wrong answers included 15/16 or 0.0675. In part (iii) II some candidates picked up ecf marks for realising that they needed to multiply their answer by 25 minutes. Part (iv) was not answered well as candidates could not explain why cobalt-60 had not decayed to a safe level after 10 years.

**Q.4** **(a)** Part (i) was well answered, with the majority being able to calculate the increase in cases. In part (ii), some candidates did not realise that their answer to the previous question needed to be substituted into the given equation. It was common to see 640 from the stem substituted or to see a random number written on answer line.

**(b)** Both parts (i) & (ii) were poorly answered. Again, many candidates answered by quoting the information in the stem and not then going a little further to say that this leads to a decrease in immunity. Candidates could not suggest a reason for the fall in vaccination rates.

**(c)** This section required recall and was poorly answered. Candidates could not state why people catch flu many times during their lifetime, but only catch measles once.

**Q.5** **(a)** Parts (i) and (ii) were both well answered. Candidates were able to complete the results table and describe the changes seen. In part (iii) it was common to see the answer 'to pump more blood' which was not given credit as the volume of blood in the body does not change. Only a minority could explain that more oxygen was needed by cells.

**(b)** This was poorly answered with few realising that 15 seconds was not long enough for the heart rate to fall to resting levels. Generally the only mark awarded was for step 1 - by measuring the heart beat for a longer time.

**Q.6** **(a)** Both parts (i) and (ii) were generally well answered by candidates. They could select information for the given graph. In part (iii) a minority of candidates could identify region BC as being the fastest motion but very few could say why. In part (iv) the majority of candidates scored at least two marks out of the four, however 20% of candidates made no attempt.

**(b)** Only approximately 25% of candidates scored on this question. Candidates were generally unable to add information to the graph.

**(c)** Candidates generally either scored full marks or no marks on this question. A common error was the height not being squared.

**Q.7** This was the QER question and was based on recall. It was generally poorly answered by the 71% of candidates that attempted it. Many candidates were not able to identify the parts of the blood from a diagram that has appeared on examination papers in the past and thus were not able to even enter the bottom marking band.

**Q.8** **(common with higher tier)**

Candidates found the common questions noticeably more difficult than the lower demand questions and performed much more poorly than the higher tier candidates.

**(a)** Candidates found it hard to express the correct scientific term when identifying different quantities, e.g. saying 'amount of' (which gets no credit) rather than mass / concentration / volume.

**(b)** A minority could identify the volume of gas produced when the reaction was finished but many could not work out the rate of reaction. It was common to see many candidates adding up all the volumes in the column of the table.

**(c)** This question required recall of collision theory that many candidates did not know. Generally, the only mark awarded was for giving a correct conclusion.

**Q.9** **(common with higher tier)**

**(a)** This part was poorly answered with little working shown so no credit could be awarded.

**(b)** Many candidates made no attempt at calculations and thus could not draw a valid conclusion.

**(c)** Similarly, many candidates made no attempt at calculations and could not state how much longer Rhian would need to cycle than jog.

**APPLIED SCIENCE (SINGLE AWARD)**

**GCSE**

**Summer 2023**

**UNIT 2 HIGHER TIER**

## Overview of the Unit

This paper is generally sat by year 11 candidates and covers all assessment objectives.

This unit tested the following topics: factors affecting human health, diagnosis and treatment, fighting disease, exercise and fitness in humans, controlling chemical reactions and controlling nuclear reactions.

There were approximately 100 entries for this tier paper. All entries were through the medium of English. Most candidates attempted most of the questions with only 1c, 5bi, 6b, 7a and 8c falling just below 90% attempt rate. Two question parts, 1a and 4bi, had a 100% attempt rate. Most candidates appeared to be appropriately entered for this tier and seemed to have the same spread of abilities to candidates from previous series.

Question 1 and 2 were common to the Foundation Tier paper.

Generally, candidates had difficulty with the following:

- Using the correct scientific words (mass/volume/concentration) when describing quantities.
- Knowing that chemotherapy slows down production of cancer cells.
- Knowing how ultrasound scans work.
- Symbols for decay particles and decay equations.

## Comments on individual questions/sections

### Q.1 (common with foundation tier)

**(a)** Candidates found it hard to express the correct scientific term when identifying different quantities, e.g. saying 'amount of' (which gets no credit) rather than mass / concentration / volume.

**(b)** A majority of candidates could identify the volume of gas produced when the reaction was finished but many could not work out the rate of reaction. It was common to see many candidates adding up all the volumes in the column of the table.

**(a)** This part was well answered with candidates able explain their answers using the collision theory.

### Q.2 (common with foundation tier)

**(a)** This part was answered well, however some candidates showed no working so no credit could be awarded.

**(b)** Most candidates attempted the calculations and could draw a valid conclusion.

**(c)** Most candidates attempted the calculations and could state how much longer Rhian would need to cycle than jog.

**Q.3** **(a)** This was the QER question about chromosomes and genes. This question was mostly recall and was attempted by 97% of candidates. The vast majority obtained some credit with a mean mark of 2 out of 6.

**(b)&(c)** Generally well answered. Candidates were able to state the cause of Down's syndrome and explain the effect of ionising radiation on genes.

**Q.4** **(a)** Part (i) was well answered with candidates able to explain the results given in the table. In part (ii), some candidates failed to understand that the precaution was required for a school setting rather than a professional laboratory.

**(b)** Part (i) was the most poorly scoring question on the paper. Candidates needed to pick a beta emitter that penetrated a short distance with a long half-life, so the source did not need replacing. Part (ii) was more successful than part (i) as candidates realised that internal radiotherapy used isotopes with a short half-life.

**(c)** This part was well answered as candidates could calculate how long it would take for the activity to drop.

**(d)** Most candidates did not know how chemotherapy stopped the production of cancer cells.

**Q.5** **(a)** Most candidates could explain why MRI scans were preferred.

**(b)** Candidates found part (i) difficult. Few candidates knew that tissue density causes reflections of ultrasound. Part (ii) was well answered with the majority being to explain how muscles move the tibia.

**Q.6** **(a)** In part (i) only a minority of candidates knew that expressing cases per 100 000 of the population was to allow for comparisons. Part (ii) was generally well answered with candidates able to carry out the calculation correctly.

**(b)** Only a minority of candidates scored more than 1 mark in this part. Candidates needed to link the reasons for the rise in measles to change in immunity or vaccination.

**(c)** The majority of candidates showed some understanding of the immune system.

**Q.7** **(a)** The only marks that tended to be awarded in this part were for the increase in the atomic numbers. Only a minority of candidates knew the correct symbol for an electron / beta particle.

**(b)** Most candidates could work out the half-life from the graph but very few could add the correct line to show the increase in the decay products formed.

**Q.8** **(a)** Many candidates gave a general description of the motion but didn't describe the acceleration and deceleration as being uniform. In addition, many did not use the data in the graph. A general description scored a maximum of 1 mark.

**(b) & (c)** were generally well answered. Candidates often gained some credit in their calculations.

**APPLIED SCIENCE (SINGLE AWARD)**

**GCSE**

**Summer 2023**

**UNIT 3 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: Our planet; and Our place in the Universe.
- Pack B tested candidates ability within the topics of: Our place in the Universe; and Our planet.
- Pack B was much more popular than Pack A.
- Candidates appeared to generally perform equally well across both packs.
- Candidates' ability to answer questions fully continues to improve, and many fewer candidates were leaving questions blank.
- It was obvious that some centres had practiced assessments on this unit with their candidates, whilst other did not.

## Comments on individual questions/sections

### Activity 1

### Task A Planning

- Some candidates are still confused by the terms: independent; dependent and controlled variables.
- On average, candidates scored over 40% on this section.
- Most candidates were able to identify some of the variables.
- Many candidates doing both packs, failed to draw a labelled diagram of the apparatus, and effectively only drew a list of apparatus, without showing how they integrated together.
- Most candidates attempted to write a method, and the quality of candidates' SPaG continues to improve, with many candidates obviously going back over their method and correcting spelling and punctuation.
- Candidates do need to be able to spell key scientific words correctly. These are generally words that can be found in the introduction to the activity.
- Centres do need to remind their candidates to check that their methods include repeats and the correct range for the experiment, as requested in the task instructions.
- Candidates still find constructing a risk assessment difficult.
- Please ensure that candidates know that:
    - Hazards require the specific nature of the hazard to be stated (e.g. spilt oil/water on the floor is a slip hazard)

- Risks must have an injury and an action (e.g. could break an arm if you fall over whilst performing the experiment). A significant minority correctly identified the relevant injuries, but did not stated the action. Please keep candidates aware that some identified Hazards, are in fact, low hazards, and as such the is 'No specific risk' and 'No specific control measures'. Risks must be related to the hazard.
- Control measures need to appropriate for the stated Hazard and Risk (e.g. wipe up any split oil/water immediately)

**Task B Collecting and recording**

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

**Task C Analysis**

- As with the planning section, candidates, on average, scored just over 46% of the available marks for this section. The common difficulties involved plotting the graph/chart, and performing calculations.
- Candidates do need to be more critical of their data, and check for obvious anomalies. These should be identified and removed from any mean calculations.
- Candidates should practice calculating mean values of repeated measurements and expressing them to the same number of decimal points as the (primary) data.
- Candidates still find it very challenging to produce accurate graphs/charts. Common mistakes involve: non-linear scales; inaccurate point plotting; and poor best-fit line drawing (if appropriate).
- It is pleasing to see that most candidates are able to describe the pattern in their results.
- Candidates found the calculations quite challenging. The majority of candidates did not correctly round numerical answers up or down to the correct number of decimal places.

**Task D Evaluation**

- As continues to be the pattern, candidates find the evaluation component of any task hardest, and on average, candidates only scored about 19% of the available marks.
- When asked about the suitability of the experiment, many candidates write about the own performance during the experiment, or state that the method was easy to follow. Candidates need to either examine the pattern in the data or give a comment about the uncertainty of the data.
- Candidates need to be more aware of the difference between repeatability and reliability, as when asked if their results are repeatable, many candidates answer using the word 'reliable'. Candidates also need to distinguish between their results for different independent variable values, and the similarity of repeated values.
- Candidates are better at spotting inaccuracies and suggesting improvements, although extensions to an investigation are not considered to be improvements.
- Many candidates find explaining the suggestion/agreement question at the end of this section a challenge. Candidates should take more time reading this question, and thinking about a suitable response, before writing their final answer. There is no credit for a simple Yes/No answer, an explanation is needed.

## Activity 2

### Task A Analysis

- Candidates scored higher on the Activity 2 analysis than they did on the Activity 1 analysis section.
- Most candidates were able to identify the correct oils for pack B, but a significant minority of candidates doing pack A failed to calculate the distance travelled by the waves correctly.
- Most candidates were able to identify the anomalous result in the data set, but many did not remove the value from their calculation of the mean, and many did not round their calculated values correctly.
- Most were able to state the pattern in their data.
- Most candidates found the calculations challenging, particularly with rounding.
- Candidates are quite good at extracting information from text or from tables, but then find applying that information more difficult.

### Task B Evaluation

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

**APPLIED SCIENCE (SINGLE AWARD)**

**GCSE**

**Summer 2023**

**UNIT 3 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: Our planet; and Our place in the Universe.
- Pack B tested candidates' ability within the topics of: Our place in the Universe; and Our planet.
- Pack B was much more popular than Pack A.
- Candidates appeared to generally perform equally well across both packs.
- Candidates' ability to answer questions fully continues to improve, and many fewer candidates were leaving questions blank.
- It was obvious that some centres had practiced assessments on this Unit with their candidates, whilst other did not.

## Comments on individual questions/sections

### Activity 1
### Task A Planning

- Some candidates are still confused by the terms: independent; dependent and controlled variables, and despite the fact that candidates are reminded to describe the variables, a significant minority fail to do this.
- On average, candidates scored nearly 50% on this section.
- Many candidates doing both packs, failed to draw a labelled diagram of the apparatus, and effectively only drew a list of apparatus, without showing how they integrated together.
- Most candidates attempted to write a method, and the quality of candidates' SPaG continues to improve, with many candidates obviously going back over their method and correcting spelling and punctuation.
- Candidates do need to be able to spell key scientific words correctly. These are generally words that can be found in the introduction to the activity.
- Centres do need to remind their candidates to check that their methods include repeats and the correct range for the experiment, as requested in the task instructions.
- Candidates still find constructing a risk assessment difficult.
- Please ensure that candidates know that:
    - Hazards require the specific nature of the hazard to be stated (e.g. spilt oil/water on the floor is a slip hazard)

- Risks must have an injury and an action (e.g. could break an arm if you fall over whilst performing the experiment). A significant minority correctly identified the relevant injuries, but did not stated the action. Please keep candidates aware that some identified hazards, are in fact, low hazards, and as such the is 'No specific risk' and 'No specific control measures'. Risks must be related to the hazard.
- Control measures need to appropriate for the stated hazard and risk (e.g. wipe up any split oil/water immediately)

**Task B Collecting and recording**

- This section continues to be the highest scoring section, with candidates, on average, scoring nearly 80% of the marks available.
- Many candidates failed to write the resolution of their ruler.
- The vast majority of candidates managed to take repeated readings across the stated range, with many obviously taking care to ensure that their repeats were similar to each other.
- Some candidates still need practice with listing units on tables and using the correct (consistent) number of decimal places on columns of numbers, particularly when calculating means.
- A significant minority of tables were very scrappy. Please encourage candidates to use the space to record their rough data and then produce a good quality 'best' table in the space at the bottom of the page.

**Task C Analysis**

- As with the Planning section, candidates, on average, scored just under 50% of the available marks for this section. The common difficulties involved plotting the graph/chart and performing calculations.
- Candidates do need to be more critical of their data, and check for obvious anomalies. These should be identified and removed from any mean calculations.
- Candidates should practice calculating mean values of repeated measurements and expressing them to the same number of decimal points as the (primary) data.
- Candidates still find it very challenging to produce accurate graphs/charts. Common mistakes involve: non-linear scales; inaccurate point plotting; and poor best-fit line drawing (if appropriate).
- It is pleasing to see that most candidates are able to describe the pattern in their results.
- Candidates found the calculations quite challenging. The majority of candidates did not correctly round numerical answers up or down to the correct number of decimal places.

**Task D Evaluation**

- As continues to be the pattern, candidates find the evaluation component of any task hardest, and on average, candidates only scored just under 35% of the available marks.
- When asked about the suitability of the experiment, many candidates write about the own performance during the experiment, or state that the method was easy to follow. Candidates need to either examine the pattern in the data, or give a comment about the uncertainty of the data.
- Candidates need to be more aware of the difference between repeatability and reliability, as when asked if their results are repeatable, many candidates answer using the word 'reliable'. Candidates also need to distinguish between their results for different independent variable values, and the similarity of repeated values.
- Candidates are better at spotting inaccuracies and suggesting improvements, although extensions to an investigation are not considered to be improvements.
- Many candidates find explaining the suggestion/agreement question at the end of this section a challenge. Candidates should take more time reading this question, and thinking about a suitable response, before writing their final answer. There is no credit for a simple Yes/No answer, an explanation is needed.

## Activity 2

### Task A Analysis

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

### Task B Evaluation

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

## SCIENCE PRACTICAL ASSESSMENT

## GCSE

## Summer 2023

### Overview of the Unit

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

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

### Comments on individual questions/sections

### Section A - Hypotheses and risk assessments

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

### Section A - Tables of results

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

### Section B – Variables

Each of the 9 tasks included a section on variables. Candidates were able to identify the independent and dependent variables across all the tasks and most were able to state the range of these variables. Less successful candidates simply listed all the values of the variable when asked for a range, but this was seen less often than in previous series. One area for development that was noted was the resolution of the instruments used.

Where this was asked it was common to see incorrect values given. Many of the tasks explored either how or why certain variables were controlled, and this was less well-answered than other areas of the section on variables. For example, in the sodium thiosulfate task, candidates were required to explain how the volume of the sodium thiosulfate was controlled but most candidates didn't state either the volume of the of the solution used or the instrument used to measure this volume. In the resistance in a wire task, candidates were asked to explain why the thickness of the wire was controlled. This was poorly answered with most candidates not linking a change in thickness with a change in resistance and current.

**Section B – Graphs**

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

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

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

**Section B - Calculations**

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

**Section B – Analysis and evaluation of results**

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

**Section B – Improvements**

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

**Section B – Use of practical terms**

Most candidates demonstrated clear understanding of practical terms such as repeatability, reproducibility, and accuracy. Similarly, candidates were confident in identifying anomalous results. Other terms, such as systematic error, were not well understood and most candidates had difficulty in clearly explaining the effect of a systematic error. The glossary of practical terms is a good reference that candidates should use when revising for these tasks.

**Section B – Planning**

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

**Section B - Science theory**

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

## Supporting you

### Useful contacts and links

Our friendly subject team are on hand to support you between 8.30am and 5.30pm, Monday to Friday.
Tel: **029 2240 4252**
Email: science@wjec.co.uk
Qualification webpage: https://www.wjec.co.uk/qualifications/applied-science-gcse-single-award/#tab_keydocuments

See other useful contacts here: Useful Contacts | WJEC

### CPD Training / Professional Learning

Access our popular, free online CPD/PL courses to receive exam feedback and put questions to our subject team, and attend one of our face-to-face events, focused on enhancing teaching and learning, providing practical classroom ideas and developing understanding of marking and assessment.

Please find details for all our courses here: https://www.wjec.co.uk/home/professional-learning/

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