GCSE MARKING SCHEME

SUMMER 2024

GCSE
APPLIED SCIENCE (DOUBLE AWARD)
UNIT 4 PACK A - HIGHER TIER
3445UD0-1

About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

WJEC GCSE APPLIED SCIENCE (DOUBLE AWARD)

UNIT 4 - PACK A

SUMMER 2024 MARK SCHEME

HIGHER TIER

GENERAL INSTRUCTIONS

Recording of marks

Examiners must mark in red ink.

Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

Marking rules

All work should be seen to have been marked.

Crossed out responses not replaced should be marked.

A banded mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide which mark to award within the level. Award the higher mark in the level if there is a good match with all the content statements and the communication statements.

Marking abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

cao = correct answer only
ecf = error carried forward
bod = benefit of doubt

Activity 1 Task A: Planning

Generic Mark Scheme

	Level 1	Level 2	Level 3
Planning	The candidate outlines a brief method to solve a practical problem. The candidate makes a plan to collect some relevant data without necessarily controlling variables.	The candidate independently devises a method to solve a practical problem which, with some changes or elaboration, could be followed by another person. Most variables are controlled	The candidate independently devises a method to solve a practical problem, which would enable the investigation to be carried out successfully by another person. All variables are controlled.
	There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with very little structure. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.	There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.	There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.
	Some equipment is identified for the task. Guidance may be required.	The candidate identifies the equipment needed for the task.	The candidate identifies the equipment needed for the task, without the inclusion of unnecessary apparatus.
	1-3	4-7	8-10
			Total Available Marks: 10
	Zero marks to be awarded where there is insufficient evidence to achieve a mark at level 1.		

Indicative content

<table>
<tr><td>1. Identifies the independent variable: length of leaf</td><td>5. Produces a labelled diagram: leaves; ruler
must be a sense that the leaf is being measured by the ruler, not just a list of pictures.</td><td>8. Uses appropriate scientific language
Length, spike, ruler – all 3 needed</td></tr>
<tr><td>2. Identifies the dependent variable: number of spikes</td><td>6. Produces a method
must include changing IV and measuring DV</td><td>9. Uses accurate spelling of scientific words
1 mistake allowed</td></tr>
<tr><td>3. Identifies 1 controlled variable: variety of holly bush / height of leaf on bush</td><td rowspan="2">7. Produces a method that would work.
must inc. repeating for {all / 30 leaves}; stating where to measure leaf length from</td><td rowspan="2">10. Uses capital letters and full stops consistently
1 mistake allowed</td></tr>
<tr><td>4. Identifies 2nd controlled variable
as above – can be in either order</td></tr>
</table>

Activity 1 Task B: Collecting and recording

Generic Mark Scheme for Activity 1

	Level 1	Level 2	Level 3
Collecting and Recording Data	The candidate uses procedures to collect data of low quality or of limited value or relevance. The quantity of data may be limited 1	The candidate uses procedures to collect mainly appropriate data of reasonable quality. The quantity of data is adequate for purposes of investigation. 2-3	The candidate uses procedures to collect data of high quality. The data is suitable and relevant to their investigation. The candidate collects a wide range of data for the investigation. 4-5
	The candidate partially records data or observations into a given template. 1	The candidate independently devises methods to record data. Their records of data are clear and largely error free. 2-3	The candidate independently devises their own format for recording results and accurately records data or observations to an appropriate degree of precision. Their data is recorded to a high standard and is easy to follow. All units correctly recorded. 4-5
			Total Available Marks: 13
Zero marks to be awarded where there is insufficient evidence to achieve a mark at level 1.			

Indicative content

Collecting		
1. Resolution stated = ±0.1 cm Accept ±1 cm, 1 mm	3. Individual leaf lengths measured / implied	5. Units of leaf length (cm) indicated somewhere near rough measurements
2. All 30 leaves measured	4. Number of spikes measured (for each leaf)	
Recording (Best table)		
1. Clearly boxed / lines so that it is easy to see rows/columns AND Words / Numbers clear to read	3. Number of spikes column header AND clear list of number of spikes for each leaf length category (mean column neutral). Must have the same number of leaves as collected. NOT 'spikes' alone	5. Units given (cm) Not: in body of table
2. Leaf <u>length</u> category header	4. Common precision used on leaf lengths (nearest cm)	

Activity 1 Task C: Analysis

Generic Mark Scheme

	Level 1	Level 2	Level 3
Analysis of Data	The candidate carries out very simple and limited processing of data. The candidate makes a very limited attempt to analyse and interpret data. The candidate gives a simple statement of findings. The candidate demonstrates a limited ability to structure the work in an appropriate way. 1-3	The candidate carries out mainly suitable and appropriate processing of data. The candidate makes an appropriate interpretation of the data using mainly appropriate methods of analysis. The candidate gives detailed conclusions largely consistent with the evidence. The work is well structured and logically argued with relatively minor errors. 4-7	The candidate carries out suitable and appropriate processing of data, transforming data into useful information. The candidate makes a detailed interpretation of data using suitable methods of data analysis. All their work can be easily followed. The candidate makes detailed conclusions consistent with the evidence. They identify and explain all the patterns within the data. The work is logically argued and is well structured. 8-10
			Total Available Marks: 10
Zero marks to be awarded where there is insufficient evidence to achieve a mark at level 1.			

Indicative content

1. Mean number of spikes calculated correctly	4. Correct labelling of x- and y-axes: Y-axis: Mean number of spikes x-axis: length of leaf / leaf length category / OWTTE with units cm	8. Value of best leaf length stated Must be one of the values with most mean number of spikes AND Due to there being most spikes
2. Suitable and consistent precision of means whole numbers	5. Y- axis scale: filling most of graph paper, inc. suitable origin. Length of bars should be at least half of paper X-axis: equally spaced bars filling over half the plottable area NB: bars can be touching or not touching Ecf line graph	9. Calculate percentage of leaves with recommended length AND then calculate number out of 3000. e.g. $\frac{number\ of\ leaves\ at\ chosen\ length}{30} \times 100 = \%$ $\frac{\%}{100} \times 3000 = answer$
3. bar chart plotted Do not accept line graph	6. All bars plotted correctly from data (± < 1 small square tolerance) Ecf line graph NB: if line graph, quality of line neutral	10. {Either species / both} acceptable as deter intruders with spikes Do not accept without explanation.
	7. Pattern described as per candidate data – must link (leaf) length and number of spikes Accept: there is no pattern	

Activity 1 Task D: Evaluation

Generic Mark Scheme

	Level 1	Level 2	Level 3
Evaluating	The candidate gives a simple evaluation of the data or procedure. 1	The candidate gives a clear evaluation of their investigation/ procedure. The candidate makes an assessment of the validity **and** quality of evidence. 2-3	The candidate gives a detailed evaluation of their investigation/procedure. They suggest suitable/relevant improvements to their method. The candidate makes a detailed assessment of the validity and quality of data. 4-5
			Total Available Marks: 5
Zero marks to be awarded where there is insufficient evidence to achieve a mark at level 1.			

Indicative content

1. Suitability of method discussed Yes, the method is suitable: a clear pattern is seen / number of spikes {does/does not} vary with length Accept No as there is no clear pattern / conclusion	3. First inaccuracy stated e.g. Different species of holly / measurement errors e.g. leaves not flat / recording errors / taking leaves from different parts of the bush / age of the bush / other correct acceptable answer	5. Suggested improvement – more leaves / same bush / same height on bush / narrower leaf length intervals / method of measuring leaves more accurately / other correct acceptable improvement. Must be improvement NOT another inaccuracy
2. Correct comment about the variation (or not) in the number of spikes per each leaf length e.g. there is no variation / there is variation within the leaf length category Not reference to pattern	4. Second inaccuracy stated As above	

Activity 2 Task A: Analysis

Generic Mark Scheme

	Level 1	Level 2	Level 3
Analysis of Data	The candidate carries out very simple and limited processing of data. The candidate makes a very limited attempt to analyse and interpret data. The candidate gives a simple statement of findings. The candidate demonstrates a limited ability to structure the work in an appropriate way. 1-3	The candidate carries out mainly suitable and appropriate processing of data. The candidate makes an appropriate interpretation of the data using mainly appropriate methods of analysis. The candidate gives detailed conclusions largely consistent with the evidence. The work is well structured and logically argued with relatively minor errors. 4-7	The candidate carries out suitable and appropriate processing of data, transforming data into useful information. The candidate makes a detailed interpretation of data using suitable methods of data analysis. All their work can be easily followed. The candidate makes detailed conclusions consistent with the evidence. They identify and explain all the patterns within the data. The work is logically argued and is well structured. 8-10
			Total Available Marks: 10
	Zero marks to be awarded where there is insufficient evidence to achieve a mark at level 1.		

(a)	(i)	• Top left: Mixture fizzes/CO_2 given out ® carbonate • Top right: sulfate • Bottom: Add (1cm^3) nitric acid ® add (few drops) silver nitrate ® white precipitate ® chloride All correct = 2 marks; 1 or 2 correct = 1 mark
	(ii)	Method: (Unknown powder): Clean flame probe / method to clean probe ® Dip in unknown ® Put in flame (1) Observations: ® orange/yellow flame ® Sodium ® lilac flame ® potassium (both positive test results needed for (1))
(b)	(i)	Set 3 sodium sulfate sodium carbonate } (1) Set 4 sodium sulfate AND potassium chloride (either order) sodium carbonate AND potassium chloride (either order) sodium sulfate AND sodium carbonate (either order) } (1)
(c)	(i)	21 (1)
	(ii)	11S3, They had the highest {(mean) scores/students} (in each test) (both correct for 1)
	(iii)	Sulfate test Did not perform it safely / didn't wear goggles / mixed up the chemicals / didn't put enough of the chemicals in / didn't follow the method (1) Both answer and explanation needed for (1)
(d)		Dilute HCl will not (react quick enough to) remove any excess chemicals from previous tests / dil HCl will not clean the probe / conc HCl will clean the flame probe / owtte (1)

Activity 2 Task B: Evaluation

Generic Mark Scheme

	Level 1	Level 2	Level 3
Evaluating	The candidate gives a simple evaluation of the data or procedure. 1	The candidate gives a clear evaluation of their investigation/ procedure. The candidate makes an assessment of the validity **and** quality of evidence. 2-3	The candidate gives a detailed evaluation of their investigation/procedure. They suggest suitable/relevant improvements to their method. The candidate makes a detailed assessment of the validity and quality of data. 4-5
			Total Available Marks: 5
Zero marks to be awarded where there is insufficient evidence to achieve a mark at level 1.			

Indicative content

1. Suitability of method discussed Yes: each test clearly identifies each chemical present	3. Suggested improvement for safety, e.g wear goggles / write and follow risk assessment / check given risk assessment / check Student Safety Sheets / safety symbols on bottles / gloves	4. No (no mark on its own – must have reason) Each class doesn't get the same number of tests performed safely and correctly / the numbers of tests correct for each class are not the same
2. Suggested reason why don't need to do sodium/potassium test e.g. all chemicals have different anions OWTTE		5. Chemicals/solutions mixed up / not all students followed the method correctly / other suitable correct answer NOT related to safety

Activity 3: Managing Safety

Generic Mark Scheme

	Level 1	Level 2	Level 3
Managing Safety	The candidate identifies some hazards and risks associated with the activity. Not all significant hazards or risks are identified.	The candidate writes a risk assessment which identifies the significant hazards with the activity and risks associated with the activity. They identify some suitable control measures.	The candidate writes a complete and suitable risk assessment for the activity. They accurately describe all the reasonable hazards and risks associated with the activity. Where necessary, they identify suitable and sensible control measures for hazards/risks listed.
	The candidate demonstrates a limited ability to communicate their knowledge and understanding of safety issues.	The candidate demonstrates a reasonable ability to communicate their knowledge and understanding of safety issues.	The candidate demonstrates an ability to communicate their knowledge and understanding of safety issues to a high standard.
	1-3	4-7	8-10
			Total Available Marks: 10
Zero marks to be awarded where there is insufficient evidence to achieve a mark at level 1.			

Stage 1 – Demonstrating the smoking machine

Hazard	Risk (must have action)	Control Measure (must be appropriate to risk/hazard) Can be awarded for incomplete risk/hazard but not incorrect Hazard
1. The burning cigarette is hot (1)	2. Skin burn whilst {lighting / extinguishing/removing} the cigarette (1)	3. Light with burning splint / make sure cigarette is in place on machine first / allow to cool before handling (1)
4. Carbon monoxide gas is: (1)	5. must be appropriate to the stated hazard (1)	6. (1)
flammable	Could cause a fire whilst experiment is running cause burn to skin whilst cigarette is burning	No naked flames around machine
	OR	OR
toxic / health hazard	could be inhaled causing {toxicity/headache} whilst experiment is running	perform experiment in fume cupboard/ wear a gas mask
		Do not accept window ventilation

Stage 2 – Testing the tar

Hazard	**Risk (must have action – accept 'when using' as an action)**	**Control Measure (must be appropriate to risk/hazard) Can be awarded for incomplete risk but not incorrect risk**
7. The cyclohexene in the tar is (1)	8. must be appropriate to the stated hazard (1)	
flammable	Could cause a burn to skin whilst testing the cotton wool for cyclohexene AND	keep naked flames away from experiment
health hazard / harmful	{burn/irritation} to the stated body part if (swallowed /inhaled} whilst testing the cotton wool for cyclohexene Accept dizziness / fatal if swallowed for injury AND	Perform experiment in fume cupboard /wear goggles /wear facemask / wear gloves
environmental hazard (1)	Pollution/damage to environment Action whilst testing the cotton wool for cyclohexene	Do not pour down sink / do not dispose of into environment OWTTE
<u>Can be awarded in stage 1 if not given in stage 2 – award best mark</u>	whilst testing the cotton wool for cyclohexene AND	`
9. Bromine water is an irritant **(1)**	10. Could irritate skin or eyes of some people during testing the cotton wool for cyclohexene AND (1)	Wear goggles / gloves

Skill Area	AO1	AO2	AO3	Maths	Prac
Activity 1: Planning	**5**	**5**			**10**
Activity 1: Collecting and recording data	**9**	**1**		**2**	**10**
Activity 1: Analysis		**9**	**1**	**4**	**10**
Activity 1: Evaluation			**5**		**5**
Activity 2: Analysis		**9**	**1**	**4**	**10**
Activity 2: Evaluation			**5**		**5**
Activity 3: Risk Assessment	**10**				**10**
Total	**24**	**24**	**12**	**10**	**60**