



GCSE MARKING SCHEME

SUMMER 2024

**GCSE
APPLIED SCIENCE (DOUBLE AWARD)
UNIT 4 –HIGHER TIER**

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.

GCSE APPLIED SCIENCE (DOUBLE AWARD) – TASK-BASED ASSESSMENT

UNIT 4 – PACK B

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

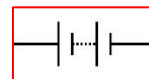
Generic Mark Scheme

	Level 1	Level 2	Level 3
Planning	<p>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.</p> <p>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.</p> <p>Some equipment is identified for the task. Guidance may be required.</p> <p style="text-align: center;">1-3</p>	<p>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</p> <p>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.</p> <p>The candidate identifies the equipment needed for the task.</p> <p style="text-align: center;">4-7</p>	<p>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.</p> <p>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.</p> <p>The candidate identifies the equipment needed for the task, without the inclusion of unnecessary apparatus.</p> <p style="text-align: center;">8-10</p>
	Total Available Marks: 10		
	Zero marks to be awarded where there is insufficient evidence to achieve a mark at level 1.		

Indicative content

Activity 1: Planning

<p>1. Identifies the independent variable: (battery or psu) voltage Accept number of batteries</p>	<p>5. Uses the correct component symbols: {battery / cell 1-4 in series / psu}, ammeter, resistor</p>	<p>8. Uses appropriate scientific language: resistor and current</p>
<p>2. Identifies the dependent variable: current</p>	<p>6. Produces a method Must include changing IV and measuring DV</p>	<p>9. Uses accurate spelling of scientific words 1 mistake allowed</p>
<p>3. Identifies 1 controlled variable: same (power) resistor / same resistance / disconnecting between readings / same voltage batteries (1.5 V) (NOT temperature)</p>	<p>7. Produces a method that would work. Must inc. repeats, correct range, disconnection between readings</p>	<p>10. Uses capital letters and full stops consistently 1 mistake allowed Each step/bullet point needs to be consistent</p>
<p>4. Draws a series circuit that would work Line must connect all components, except for little gaps between cells</p>		



Activity 1 Task B: Collecting and recording

Generic Mark Scheme

	Level 1	Level 2	Level 3
Collecting and Recording Data	<p>The candidate uses procedures to collect data of low quality or of limited value or relevance. The quantity of data may be limited</p> <p style="text-align: center;">1</p>	<p>The candidate uses procedures to collect mainly appropriate data of reasonable quality. The quantity of data is adequate for purposes of investigation.</p> <p style="text-align: center;">2-3</p>	<p>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.</p> <p style="text-align: center;">4-5</p>
	<p>The candidate partially records data or observations into a given template.</p> <p style="text-align: center;">1</p>	<p>The candidate independently devises methods to record data. Their records of data are clear and largely error free.</p> <p style="text-align: center;">2-3</p>	<p>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.</p> <p style="text-align: center;">4-5</p>
	Total Available Marks: 10		
Zero marks to be awarded where there is insufficient evidence to achieve a mark at level 1.			

Indicative content

Collecting		
1. Resolution stated = 0.01 A Consistent with candidate data	3. {All / at least} 5 voltages (inc. zero) tested across 0-6V range	5. Repeats similar in magnitude approx. $\pm 10\%$ of mean
2. Rough measurements taken Accept best table as rough	4. Currents recorded and repeated <u>twice</u> (3 values of current)	
Recording (Bottom / best table)		
1. Clearly boxed / lines so that it is easy to see rows/columns AND Words / Numbers clear to read	3. Current column header (not just amps) (ecf from plan e.g. 'reading on ammeter' if stated as dependent variable) AND repeat columns clearly shown under current heading	5. Units given: A and V – can be words not in body of table
2. Voltage column header not just volts Ecf from plan, e.g. number of batteries as IV	4. Common precision used on currents and voltage same 2 dps on currents – including 0.00, and 1dp on voltage (mean neutral)	

Activity 1 Task C: Analysis

Generic Mark Scheme

	Level 1	Level 2	Level 3
Analysis of Data	<p>The candidate carries out very simple and limited processing of data.</p> <p>The candidate makes a very limited attempt to analyse and interpret data.</p> <p>The candidate gives a simple statement of findings.</p> <p>The candidate demonstrates a limited ability to structure the work in an appropriate way.</p> <p style="text-align: center;">1-3</p>	<p>The candidate carries out mainly suitable and appropriate processing of data.</p> <p>The candidate makes an appropriate interpretation of the data using mainly appropriate methods of analysis.</p> <p>The candidate gives detailed conclusions largely consistent with the evidence.</p> <p>The work is well structured and logically argued with relatively minor errors.</p> <p style="text-align: center;">4-7</p>	<p>The candidate carries out suitable and appropriate processing of data, transforming data into useful information.</p> <p>The candidate makes a detailed interpretation of data using suitable methods of data analysis. All their work can be easily followed.</p> <p>The candidate makes detailed conclusions consistent with the evidence. They identify and explain all the patterns within the data.</p> <p>The work is logically argued and is well structured.</p> <p style="text-align: center;">8-10</p>
	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 currents calculated correctly with suitable precision (same as data)	5. Suitable line drawn: linear / best-fit labelled A not join the dots	8. & 9. Values: must be to correct sf for both marks)		
2. Mean current v voltage graph plotted NB: no marks for bar chart as question told candidates to plot graph using correct axis header: mean current (A) on y-axis – must include units	6. Pattern described: mean current increases with voltage {at the same rate / linear / proportional}	Power resistor	Power (W)	Resistance (Ω)
3. Suitable linear scale filling most of graph paper, inc. suitable origin. Plotted area should be at least half of paper	7. Straight line through the origin and (4.5 V, 0.25 A) – labelled B.	A	2.51	5.60
4. All points plotted correctly $\pm < 1$ small square tolerance (ecf from 1/2/3)		B	0.79	17.86
		1 mark for each correct column Only penalise once for incorrect sf		
		10. (Power) resistor A has the higher power (so produces more heat energy per second) Accept A has the highest current		

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.	The candidate gives a clear evaluation of their investigation/ procedure. The candidate makes an assessment of the validity and quality of evidence.	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.
	1	2-3	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 / current changes with voltage	3. Inaccuracy stated Voltages not exactly as stated on the {battery pack / cells/ or psu} / {battery /cells) may be running down owtte / not disconnecting the resistor quick enough / other acceptable answer	5. Qualified answer to Simon's comment with reference to the candidate's data: Yes – {data/points/graph} shows that doubling the voltage doubles the current / best fit line is linear (straight) / graph shows current is proportional to voltage / exemplification by stating data points (e.g. 3 V and 6 V). No – data shows that doubling the voltage does not (exactly) double the current / exemplification by stating data points (No mark for just Yes/No)
2. Qualified statement about the repeatability of the data. Repeatable because repeated values are similar / no anomalies Not repeatable because repeated values are not similar (No mark for repeatable/not repeatable)	4. Suggested improvement Use a power supply / measure voltages using a voltmeter / measure voltage at same time as the current / more precise ammeter / more repeats / use larger range of voltage readings OWTTE / use new batteries for each reading / use fully charged batteries	

Activity 2 Task A: Analysis

Generic Mark Scheme

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

Indicative content

1.	(a)	(i)	(1000, 3.1) (1)
		(ii)	2.4 3.8 (not 3.7 or 3.76 recurring) both needed for (1)
	(b)		All points plotted correctly ($\pm < 1$ small square) (Missing salinities: (1000,18) and (1500,5) (1) Best fit curves or point-to-point – mean mass of sediment with increasing gradient (1) Best fit curves or point-to-point - salinity reverse stretched 's' shape (1)
	(c)		As salinity decreases, the (mean) mass of sediment increases (1)
	(d)		1800 m (± 50 m) (1)
2.	(a)		Any 2 from: Phytoplankton / Sea grasses / Marsh grasses (1)
	(b)		Small invertebrates / Marsh grass / Macro algae (all 3 correct = 2 marks, 1 or 2 correct = 1 mark)

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.	The candidate gives a clear evaluation of their investigation/ procedure. The candidate makes an assessment of the validity and quality of evidence.	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.
	1	2-3	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: a clear pattern is seen / mass of sediment changes with distance away from the mouth of the estuary. No mark for unqualified Yes	3. To mix the suspension agent and the estuary water properly / to ensure that all the suspended particles in the sample bond together and form a sediment / to ensure there is a chemical reaction	4. To remove all the water from the sample / any water left in the sample will be measured (incorrectly) as sediment / owtte
2. Repeats needed to spot anomalies / increase precision / calculate a mean value / reduce uncertainty Not increase accuracy / reliability		5. Qualified answer to Dewi's suggestion: NO – do not agree, because there would be little detectable change between readings over an interval of 25 m. Not an argument based on time to take results

Activity 3: Managing Safety

Generic Mark Scheme

	Level 1	Level 2	Level 3
Managing Safety	<p>The candidate identifies some hazards and risks associated with the activity. Not all significant hazards or risks are identified.</p> <p>The candidate demonstrates a limited ability to communicate their knowledge and understanding of safety issues.</p> <p style="text-align: center;">1-3</p>	<p>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.</p> <p>The candidate demonstrates a reasonable ability to communicate their knowledge and understanding of safety issues.</p> <p style="text-align: center;">4-7</p>	<p>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.</p> <p>The candidate demonstrates an ability to communicate their knowledge and understanding of safety issues to a high standard.</p> <p style="text-align: center;">8-10</p>
	Total Available Marks: 10		
Zero marks to be awarded where there is insufficient evidence to achieve a mark at level 1.			

Stage 1 – Performing the Biuret (protein) test

Hazard	Risk must have action	Control Measures must be appropriate to risk/hazard
1. 0.15 mol/dm ³ sodium hydroxide is an irritant (1)	2. Solution could get on and irritate skin or in eyes during pouring the Biuret into the test tube. AND (1)	i. Wear goggles ii. Wash off skin immediately
3. 0.5 mol/dm ³ copper(II) sulfate is corrosive and an irritant (1) Accept dilute for concentration	4. Solution could get on and burn/irritate skin or in eyes during pouring the Biuret into the test tube. AND (1)	i. Wear goggles ii. Wash off skin immediately

Stage 2 – Performing the Benedict's (simple sugar) test

Hazard	Risk must have action – accept 'when using' as an action	Control Measures must be appropriate to risk/hazard
5. The water in the water bath is hot (1)	6. Hot water could scald/burn skin/eyes when heating the solution/operating the water bath AND (1)	i. Wear goggles ii. flush skin with cold water for 10 minutes / wear heat protective gloves
7. The solution/test tube (1) is hot	8. Hot solution/test tube could scald/burn skin/eyes when removing the test tube from the water bath. AND (1)	Handle only with a test tube holder
9. 0.01 mol/dm ³ copper(II) sulfate is a low hazard (1) accept very dilute for concentration	10. No risk AND (1)	No control measure

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