



GCSE MARKING SCHEME

SUMMER 2018

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

INTRODUCTION

This marking scheme was used by WJEC for the 2018 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

WJEC GCSE APPLIED SCIENCE (DOUBLE AWARD)

UNIT 4 PACK A (NEW)

SUMMER 2018 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.		

Activity 1 Task A Planning

Marking Guidance – Expected responses – please refer to generic marking scheme; candidates may give other acceptable (correct) answers that fulfil the criteria. The responses below are for guidance only.

Independent variable – The fermentation temperature

Controlled variables – The same (diameter of) measuring cylinder; same concentration of yeast suspension and 5% glucose solution; same volume of yeast suspension and 5% glucose solution, same time

Dependent variable – the volume of the froth produced in 5 minutes.

Equipment – candidates may use equipment from the list or other suitable equipment; candidates may use annotated diagrams rather than a list.

Procedure (exemplification)

Step 1. Set up water at 20°C

Step 2. Place a measuring cylinder containing 100 cm³ of yeast suspension in the beaker and allows time for temperature to equalise

Step 3. Allow to respire for 5 mins

Step 4. Record the new 'height' of the suspension 'froth' (yeast and bubbles)

Step 5. Repeat steps 1 to 4 for temperatures of 30°C, 40°C, 50°C and 60 °C.

Level 3 – Candidate produces independent, viable method (similar to above); important control variables (above) addressed; coherent, relevant and logical plan; appropriate scientific terminology and accurate spelling, punctuation and grammar with few mistakes; all relevant equipment identified (via list or annotated diagram), without unnecessary apparatus.

Level 2 - Candidate produces independent method, that with some changes, could be followed by another person; most of the important control variables addressed; partially coherent, relevant and logical plan; mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar; all equipment needed for the task identified, may have some unnecessary apparatus.

Level 1 - Candidate produces brief method that will allow some relevant data to be collected; may not address the control variables; basic line of reasoning, not coherent, largely irrelevant with very little structure; limited scientific terminology and inaccurate spelling, punctuation and grammar; some equipment needed for the task identified, may need guidance.

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.			

Activity 1 Task B Collecting and Recording

Marking Guidance – Expected responses – please refer to generic marking scheme; candidates may give other acceptable (correct) answers that fulfil the criteria. The responses below are for guidance only.

Collecting –

Level 3 – 5 different temperatures used; volume of froth recorded (including subtracting the initial volume of the yeast/glucose mixture)

Level 2 – 5 different temperatures used; volume of froth recorded, may not subtract the initial volume of the yeast/glucose.

Level 1 – May not test 5 different temperatures

Recording –

Level 3 – Candidate devises own table; temperatures and volume of froth in 5 minutes clearly recorded for each test, for each temperature; all units recorded clearly and correctly.

Level 2 – Candidate devises own table; initial volume of yeast/glucose mixture not taken into account; not all units recorded correctly.

Level 1 – Candidate uses a template; not all measurements recorded.

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.		

Activity 1 Task C Analysis

Marking Guidance – Expected responses – please refer to generic marking scheme; candidates may give other acceptable (correct) answers that fulfil the criteria. The responses below are for guidance only.

Graph:

- Correctly labelled axes
- Correct scale
- Plotting (less than 1 square tolerance)
- Suitable line (point to point or smooth curve)

The temperature that would be the best for Brewerz to use should be stated – one of the temperatures is stated or attempt at interpolation.

Reasons for conclusion. – reasons given could include: largest volume of froth produced in 5 minutes; largest volume of carbon dioxide produced in 5 minutes. Higher level answers will include some form of qualification relating reasons to the intended use, including economic reasons

Level 3 – mean volume of froth produced in 5 minutes calculated; ‘best’ temperature is suggested; ‘best’ temperature is consistent with candidate’s data; reasons given for choice of ‘best’; qualifications given relating reasons to intended use; other considerations such as taste; cost may be included; logical arguments and well structured.

Level 2 – mean volume of froth produced in 5 minutes calculated; ‘best’ temperature is suggested; ‘best’ temperature is consistent with candidate’s data; reasons given for choice of ‘best’; may not include any qualifications of ‘best’ or qualifications invalid; logical arguments and well structured, with relatively minor errors.

Level 1 – limited analysis of data, may include individual volumes of froth produced in 5 minutes (not mean); ‘best’ temperature suggested without any reasons OR invalid/trivial reasons given; no qualifications OR invalid/trivial qualifications given; limited structure to answers.

ACTIVITY 1 TASK D: EVALUATION

Generic Mark Scheme

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

Activity 1 Task D Evaluation

Marking Guidance – Expected responses – please refer to generic marking scheme; candidates may give other acceptable (correct) answers that fulfil the criteria. The responses below are for guidance only.

method: – Comment about whether (or not) the method actually measures the volume (as opposed to froth); comment about the ability of the procedure to measure differences between the volume of carbon dioxide produced in 5 minutes at each temperature; no repeats, temperature changes during the experiments as the water cools.

Inaccuracies may include: accurately deciding the level of the froth; some carbon dioxide not trapped in the froth; changing temperature.

Suggest ways to improve your method. – any sensible suggestions to the method or equipment. These may include repeating, use of gas syringe or measuring cylinder to collect gas, using a narrower measuring cylinder.

Quality of data. – Candidates should make a comment on whether the results are repeatable or not – need repeat; explanation of comment. Comment related to expected pattern of results.

Candidates should make a comment on whether the experiment is able to answer the question ‘Which temperature would be the best for Brewerz to use with the yeast?’ or not; explanation of the comment.

Level 3 – Candidates address the majority of the points in the generic mark scheme in detail.

Level 2 – Candidates address the majority of the points in the generic mark scheme.

Level 1 – Candidates briefly address some of the points in the generic mark scheme.

ACTIVITY 2 TASK A: ANALYSIS

Generic Mark Scheme for Activity 2

	Level 1	Level 2	Level 3
Analysis of Data	The candidate carries out very simple and limited processing of data.	The candidate carries out mainly suitable and appropriate processing of data.	The candidate carries out suitable and appropriate processing of data, transforming data into useful information.
	The candidate makes a very limited attempt to analyse and interpret data.	The candidate makes an appropriate interpretation of the data using mainly appropriate methods of analysis.	The candidate makes a detailed interpretation of data using suitable methods of data analysis. All their work can be easily followed.
	The candidate gives a simple statement of findings.	The candidate gives detailed conclusions largely consistent with the evidence.	The candidate makes detailed conclusions consistent with the evidence. They identify and explain all the patterns within the data.
	The candidate demonstrates a limited ability to structure the work in an appropriate way.	The work is well structured and logically argued with relatively minor errors.	The work is logically argued and is well structured.
	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.			

Activity 2 Task A Analysis			
Marking Guidance – Expected responses – please refer to generic marking scheme; candidates may give other acceptable (correct) answers that fulfil the criteria. The responses below are for guidance only.			
(a)	(i)		2 spatulas, 86 (first value)
	(ii)		67 (ecf) 96 (allow 95.75/95.8)
(b)			126 s
(c)	(i)		6.9-7.1 g
	(ii)		5.26 cm ³ (equation needs rearrangement) accept incorrect rounding
(d)	(i)		Curved line with decreasing gradient from (1, 20) to (10, 160) with < 1 small square tolerance ignore plots from (0,0)
	(ii)		Pellets appear to burn for less time than tablets so are less effective accept converse argument
			Level 3 – Candidates address the majority of the points in the generic mark scheme in detail Level 2 – Candidates address the majority of the above points in the generic mark scheme Level 1 – Candidates briefly address some the points in the generic mark scheme

ACTIVITY 2 TASK B: EVALUATION

Generic Mark Scheme

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

Activity 2 Task B Evaluation

Marking Guidance – Expected responses – please refer to generic marking scheme; candidates may give other acceptable (correct) answers that fulfil the criteria. The responses below are for guidance only.

Candidates should evaluate:

The suitability of the method to measure the burn time for different masses of BBQ gel. – method is valid; the mean burn time increases for increasing spatulas of gel; the repeats for each number of spatulas are close together (repeatable); you can see a pattern.

Ways to improve the method. – vary the mass of the gel not the number of spatulas; more repeats; extend the range.

The suitability of the method to determine which mass of BBQ gel would be best for lighting a BBQ. – the pattern seems to show that the burn time increases rapidly for low masses of gel (number of spatulas of gel), but then starts to level off; 4 spatulas only burns for a few seconds more than 3 spatulas, suggesting 3 spatulas is best; need to test 5 / 6/ 7 spatulas (or more higher masses).

Comments may be in extended prose.

Level 3 – Candidates address the majority of the points in the generic mark scheme in detail.

Level 2 – Candidates address the majority of the points in the generic mark scheme.

Level 1 – Candidates briefly address some of the points in the generic mark scheme.

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>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>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>
	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.			

Activity 3 Risk Assessment

Marking Guidance – Expected responses – please refer to generic marking scheme; candidates may give other acceptable (correct) answers that fulfil the criteria. The responses below are for guidance only.

Stage 1

Hazard	Risk	Control Measure
Stream bed is slippery	falling over in the stream whilst collecting	Wear suitable footwear; do not move into water above knee level; always work with a partner; move slowly through the water.
Organisms in water carry disease	could become infected by the disease whilst {collecting/handling}	Do not consume the water; do not rub eyes with wet hands, cover any cuts; wash hands after handling/wear gloves

Stage 2

Hazard	Risk	Control Measure
Drying oven is hot	Burn to skin whilst handling (OWTTE)	Do not touch the inside (hot surfaces) of the oven/wear heat-proof gloves
Shells are sharp	{Skin cuts/ puncture wounds/ eye wounds} whilst {grinding/crushing/transferring}	Ensure all shell fragments have been ground into fine fragments/wear gloves/wear goggles
(2 mol/dm ³ hydrochloric) acid is an irritant	May transfer from hand to eyes whilst pouring	Wear goggles; wash off any acid on skin.

Level 3 – Candidates address all the points. They give feasible control measures for each hazard identified.

Level 2 – Candidates address some hazards and risks and identify corresponding control measures.

Level 1 – Candidates address some hazards / risks and may identify corresponding control measures.

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