GCSE MARKING SCHEME

SUMMER 2018

GCSE (NEW)
APPLIED SCIENCE (DOUBLE AWARD)
UNIT 4 PACK B - 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 B (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	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. 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. Some equipment is identified for the task. Guidance may be required. 1-3	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. 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. The candidate identifies the equipment needed for the task. 4-7	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 sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. The candidate identifies the equipment needed for the task, without the inclusion of unnecessary apparatus. 8-10
			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 above; candidates may give other acceptable (correct) answers that fulfil the criteria. The responses below are for guidance only.

Independent Variable – The type of packaging material

Controlled Variables – The same apparatus; same Bunsen burner flame; packaging material allowed to catch fire in the Bunsen flame; same type of each packaging materials; same mass/dimensions/surface area of each packaging material; same person timing the burning/same criteria for start and end points; same start and end point of burning.

Dependent Variables – The burn time of each piece of packaging material/the burn time per unit mass; the mass of each piece of packaging material.

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

Method (exemplification)
Step 1: Select packaging material (and cut to size if required, making all samples approximately similar mass).
Step 2: Measure and record the mass of the packaging material.
Step 3: Hold the packaging material in a pair of tongs; put packaging material into Bunsen burner flame until it catches fire; start a stopwatch.
Step 4: Measure and record the burn time of the packaging material.
Step 5: Repeat Step 1 to 4 for another piece of the same packaging material.
Step 6: Repeat Step 1 to 5 for the other two types of packaging.

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	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: 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 – 3 different packaging materials used; repeats similar in magnitude; burn times measured to the appropriate precision of the stopwatch; masses measured to the appropriate precision of the balance; packaging materials all of (approximately) similar mass. Level 2 – Repeats may be very different; may not record masses for each piece of packaging material; may round measurements. Level 1 – May not test 3 different types of packaging material; may not repeat measurements.
Recording – Level 3 – Candidate devises own table; masses and burn times clearly recorded for each repeat, of each piece of packaging material; appropriate precision used for all measurements; all units recorded clearly and correctly. Level 2 – Candidate devises own table; measurements may not be to appropriate precision; 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	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.		

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.
Burn times per unit mass calculated for each material - take ERATUM into account Candidates should suggest which packaging material would be the best for the brand – one of the materials is stated. Reasons given could include: e.g. difficulty to ignite/ mass in relation to volume ratio of packaging material/smokiness. Higher level answers will include some form of qualification relating reasons to the intended use. Answers may be in extended prose
Level 3 – individual burn times /g calculated; mean burn time /g calculated; 'best' packaging material is suggested; 'best' packaging material is consistent with candidate's data; reasons given for choice of 'best'; qualifications given relating reasons to intended use; other considerations such as density (or similar), difficulty of ignition may be included; logical arguments and well structured. Level 2 – individual burn times /g calculated OR mean burn time calculated (without taking into account mass); 'best' packaging material is suggested; 'best' consistent with their analysis, i.e. may be based on mean burn time only; at least one reason 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 burn times /g OR mean burn time of SOME of the data; 'best' packaging 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	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.			

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.
Candidates should consider: Sources of inaccuracy in the method. - Inaccuracies may include: starting and stopping the stopwatch (reaction times and/or deciding when the material is alight and when the flame has gone out); using materials with very different masses/dimensions; measuring instrument precisions/offsets. Ways to improve the method. – any sensible suggestions to the method or equipment e.g. increase number of repeats/all the same shape OWTTE Quality of data - Repeatability of results. – Candidates should make a comment on whether the results are repeatable or not; explanation of comment. Comment on the suitability of the experiment to answer the question 'Which material would be best for the packaging?' – Candidates should make a comment on whether the experiment is able to answer the question or not; explanation of the comment. Validity of conclusion - Suitability of the method to compare the burn time per gram for each packaging material. – Comment about whether (or not) the procedure actually measures the burn time /g; comment about the ability of the procedure to measure differences between the burn time /g for each different material; relevant comment about using the mass (or not), e.g. too few repeats so doesn't answer question. 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 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.		

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)	A = Stonefly nymph; B = Mayfly nymph; C = Cranefly larva; D = Dragonfly nymph; E = Bristleworm; F = Midge larva
		(ii)	B, Sample point 2
	(b)		Anywhere between sample points 2 and 3; could be Sewage works B or Industrial estate C. (Named) animals that only live in un-polluted water, such as A and B, are found upstream at sample points 1 and 2, but not downstream at sample points 3 and 4. (Named) animals that are indicators of pollution, such as E and F, are found downstream of sample points 3 and 4, but not upstream at sample points 1 and 2. Sewage works B; unpolluted water species live at sample point 2 and upstream, and polluted water species live at sample point 3 and downstream; the Sewage works B is situated between sample points 2 and 3.
	(c)		All species absent from October to April All species start to appear in May; approx. normal distributions/increase and decrease (owtte); damselfly nymph numbers peak in June; mayfly nymph and stonelfly nymph number peak in August; no damselfly nymphs found in September; mayfly nymphs numbers always higher than damselfly nymphs; other correct answer.
			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 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.			

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.
Method Suitability of the method to compare the numbers of invertebrates at each sampling point. – procedure is valid; the numbers of the different invertebrates are different at each sampling point; the method identifies non-polluted water indicator species in non-polluted water; and polluted water species in polluted water; the method does not produce produces negative results – no non-polluted water species were identified in the polluted water (and vice-versa). Suggest ways to improve the method. – sample at points closer together; repeat measurements at each sampling point; spend more time at each sampling point collecting more individuals; identify other indicator species not included on key; collect water samples and undertake chemical or microbiological tests on the water samples. Comment on the suitability of the method to identify the exact source of pollution. – the distance between the sample points is too big to distinguish between the Sewage works B and the Industrial estate C as the source of the pollution; the pollution incidents could have happened anywhere between 2 and 3; more sampling would need to be done closer together or immediately downstream of both the Sewage works B and the Industrial estate C. 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	The candidate identifies some hazards and risks associated with the activity. Not all significant hazards or risks are identified. The candidate demonstrates a limited ability to communicate their knowledge and understanding of safety issues.	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 demonstrates a reasonable ability to communicate their knowledge and understanding of safety issues.	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 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.			

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
Scalpel blade is sharp	Cut to skin when cutting tablet	Tablet should be held securely by same person cutting / fingers away from cutting blade. Place tablet on cutting tile and press down onto the tablet and tile. Cut away from the body/Do not press too hard.
Hexane BBQ tablet is harmful	Possibility of contact with {eyes/skin} when handling	Use the smallest amount possible; wear eye protection (safety spectacles)/wear gloves/wash hands

Stage 2

Hazard	Risk	Control Measure
Hexane BBQ tablet is flammable	Burn to {skin/eyes/hair} whilst handling	Keep tablet away from naked flames at all times. Keep tablet box away from naked flames. Use the smallest amount possible; ensure the room is well ventilated/perform in fume cupboard.
Apparatus is hot	Burn to skin whilst handling	Allow hot apparatus to cool before handling apparatus/wear heat-proof gloves
Bunsen burner flame is hot	Burn to {skin/eyes/hair} whilst handling	Only use roaring flame for ignition of splints, otherwise keep on safety flame/ keep away from {skin / hair / loose clothing}; put out flame when not required.

Level 3 – Candidates address all the above 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**