



GCSE MARKING SCHEME

SUMMER 2022

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

INTRODUCTION

This marking scheme was used by WJEC for the 2022 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.

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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; candidates may give other acceptable (correct) answers that fulfil the criteria. The responses below are for guidance only.

Independent variable = release distance of marble up the ramp

Dependent variable = distance moved by foam block

Controlled variables = same material block / same angle of ramp / same surfaces / same dimensions of block / same marble / any other correct

A suitable diagram

Method (exemplification)

Step 1: Set-up apparatus as shown in the diagram.

Step 2: Place the marble at a release distance of 5 cm up the ramp.

Step 3: Release the marble and measure and record the distance moved by the foam block

Step 4: Repeat Step 3 twice more.

Step 5: Repeat Steps 2 to 4 for release distances of 10, 15, 20 and 25 cm.

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 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 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. 1-3	The work is well structured and logically argued with relatively minor errors. 4-7	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. Identifies the independent variable (release distance of marble up the ramp/height of marble / release point)	5. Produces a diagram (main equipment must be shown and labelled – ramp/block/marble/ruler)	8. Uses appropriate scientific language (distance/repeat)
2. Identifies the dependent variable (distance moved by the foam block)	6. Produces a method (must include changing IV and measuring DV)	9. Uses accurate spelling (1 mistake allowed) Only technical words
3. Identifies 1 controlled variable (block/block material/block dimensions/ block starting point/ramp angle/ release without pushing /surface/marble/same method of measuring) NOT: general 'same apparatus'	7. Produces a method that would work (must inc. repeats / correct range)	10. Uses capital letters and full stops consistently (1 mistake allowed)
4. Identifies 2 or more controlled variables (as above – any 2)		

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)	It lies within the Asteroid Belt / between Mars and Jupiter (1)
	(ii)	Ceres <u>does not</u> have enough mass (for its gravity to clear all the surrounding space on its orbit around the Sun.) (1) Allow: Ceres only has a mass (relative to moon) of 0.00015 Do not accept: smaller than Moon/ it has a low/small mass
(b)	(i)	Correct labels <u>must have units</u> (1); 3 or 4 correctly plotted points $\pm < 1$ small square (1); best fit line (curve) (1)
	(ii)	As distance from the Sun increases, so the Year length increases <u>at an increasing rate OWTTE</u> (1)
(c)	(i)	Systematic error (1)
	(ii)	0.5 (1) (Earth days) ignore any ref to $\pm$
	(iii)	17.55 accept 17.6 or 18 (1) Do not accept 17.5 Accept $\sqrt[3]{5403}$
(d)		No, do not agree. There is no pattern between these two variables. (owtte) (Need both statements) (1)
		Level 3 – Candidates address all the points in the generic mark scheme in detail. Level 2 – Candidates address all 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 is suitable with reason Suggested reason such as weather. Suggested reason such as sometimes the moons are on the other side of Jupiter, which obscures them. Suggested improvement such as record the measurements over a longer period of time / get more people to do the measurements / use bigger binoculars, telescopes / do the observations somewhere where the weather is better. Comment on reproducibility (good – values within 0.1 of the means) with the exception of Bryn.
Level 3 – Candidates address all the points in the generic mark scheme in detail. Level 2 – Candidates address all the points in the generic mark scheme. Level 1 – Candidates briefly address some of the points in the generic mark scheme.

Indicative content

1. Comment on the suitability and why it is suitable. (e.g. allows us to observe movement of moons/allows us to get results – allow anything sensible) Need judgement and reason	3. Suggested reason such as sometimes the moons are on the other side of Jupiter, which obscures them OR can eclipse each other owtte Not: the weather/far away	4. Suggested improvement such as record the measurements over a longer period of time / get more people to do the measurements / use bigger binoculars, telescopes / better binoculars / do the observations somewhere where the weather is better / do it in the summer
2. Suggested reason such as weather (owtte).		5. Comment on reproducibility (good – values within 0.1 of the means / values similar) with the exception of Bryn. Accept: Good because three out of four are {close to the mean/similar} / all except one are close to mean Not converse argument

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. 1-3	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. 4-7	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. 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:

Stage 1: Hazard	Risk (must include injury and action– <u>allow handling as action</u>) Allow reference to a step in the method for action	Control Measure (Must be linked to Risk)
The Bunsen burner flame is hot AND	(Naked flame) could {burn skin / hair / clothes} whilst flaming the powder. AND (1)	only hold cold end of flame probe / tie back hair / tuck in loose clothes e.g. ties. / move by base Neutral: wear heat proof gloves
(0.2 mol/dm ³) sodium hydroxide (1) solution is an irritant	Solution could irritate the eyes or the skin when pipetting/pouring the solution into the test tube (1)	Wear goggles / wash off skin immediately with (cold running water) (1)
(7 mol/dm ³) hydrochloric acid is corrosive / irritant (1)	Could cause a chemical burn on the skin, eyes OR fumes could damage lungs during preparation of the flame probe or pouring (1)	Use smallest possible quantity/wear goggles/wear (protective) gloves/perform experiment in a fume cupboard/wash burn with water (1)

Stage 2:

Hazard	Risk	Control Measure
(0.1 mol/dm ³) silver nitrate solution is an irritant (1) OR	Solution may irritate, harm the eyes or a cut when pipetting/pouring the solution into the test tube (1) Allow ecf: if corrosive stated for hazard – allow severe eye damage/stains to skin OR	Wear goggles / wash off skin immediately (with cold running water) (1) OR
Water is hot (1)	Scalds to skin whilst dissolving silver nitrate / pouring (1)	Wear heat proof gloves / use tongs / use test tube rack OWTTE (1)

Level 3 – Candidates address all the above points

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 2: Analysis		9	1	4	10
Activity 2: Evaluation			5		5
Activity 3: Risk Assessment	10				10
Total	15	14	6	4	60