GCSE MARKING SCHEME

SUMMER 2023

GCSE
SCIENCE (DOUBLE AWARD) – UNIT 6
HIGHER TIER
3430UF0-1

INTRODUCTION

This marking scheme was used by WJEC for the 2023 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.

GCSE SCIENCE (DOUBLE AWARD) UNIT 6 – PHYSICS 2

HIGHER TIER

SUMMER 2023 MARK SCHEME

GENERAL INSTRUCTIONS

Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (apart from the questions where a level of response mark scheme is applied).

Question totals should be written in the box at the end of the question.

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.

Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.

Crossed out responses not replaced should be marked.

Credit will be given for correct and relevant alternative responses which are not recorded in the mark scheme.

Extended response question

A level of response 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 both the content statements and the communication statement.

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

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)	(i)		Alcohol / drugs / old age / tiredness Accept <u>longer</u> reaction time **or** use of mobile phones Don't accept poor visibility	1			1		
		(ii)		Icy or wet road / worn brakes / worn tyres Accept <u>greater</u> mass Don't accept weather not qualified	1			1		
	(b)			Thinking distance will halve from 12 to 6 m (1) Braking distance {will be $\frac{1}{4}$ / is 6 not 12 [m] / decreases from 24 to 6 [m] which is not a half} (1) Stopping distance {will be $\frac{1}{3}$ / is 12 not 18 [m] / decreases from 36 to 12 [m] which is not a half} (1)			3	3		
				Question 1 total	**2**	**0**	**3**	**5**	**0**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		Because {decay / dice throwing} is random / this smooths out fluctuations in the data / reduces effect of anomalies			1	1		1
		(ii)		1 in 8 should decay **or** $\frac{1}{8}$ of 500 = [62.5 on each throw] (1) So about 60 should be removed **or** 500 – 62.5 = 437.5 (1)			2	2	2	2
	(b)	(i)		All 5 points correctly plotted < 1 small square tolerance (2) 4 points correctly plotted < 1 small square tolerance (1) 3 or less points correctly plotted < 1 small square tolerance (0) Smooth curve of best fit between 0 – 8 throws (1)		3		3	3	3
		(ii)		**At least 1** construction line shown on graph (1) Value correct from candidate's graph – expect 5.1 [throws] (1) If answer is exactly 5.0 accept 5		2		2		2
		(iii)		Fewer dice will decay [on each throw] / 1 in 10 decay [on each throw] / only 50 decay [on the 1st throw] / lower chance of decay [on each throw] (1) Accept converse argument so it will take more throws to remove ½ / so the half-life is longer (1) [so disagree]			2	2		2
				Question 2 total	**0**	**5**	**5**	**10**	**5**	**10**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)		Gravitational (1) Earth (1)		2		2		
		(ii)		Equal **and** opposite Accept they are balanced	1			1		
		(iii)		Substitution: 1.5 = $m \times 10$ (1) Mass = 0.15 [kg] (1)	1	1		2	2	
	(b)	(i)		10 [m/s^2] accept 9.8 [m/s^2]		1		1		
		(ii)		1.25 [N]		1		1		
		(iii)		Substitution into: $F = ma$ i.e. 1.25 **ecf** = 0.15 **ecf** $\times a$ (1) Rearrangement: $a = \frac{1.25}{0.15}$ (1) = 8[.3] [m/s^2] (1)	1	1 1		3	3	
	(c)			No air resistance [on the moon] (1) Accept drag So acceleration is same so agree (1) Accept speeds up the same			2	2		
				Question 3 total	**3**	**7**	**2**	**12**	**5**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)			**Indicative content:** **Description of the types of radiation** Alpha is a helium nucleus. Beta is a fast moving electron. Gamma is an em wave. **Properties of the types of radiation** Alpha is highly ionising but weakly penetrating, absorbed by paper. Beta is quite ionising and quite penetrating, it is blocked by thin aluminium. Gamma is highly penetrating, blocked by thick lead but not very ionising. **Consequences for storage** Need suitable shielding / lead to prevent gamma radiation escaping. Needs to be in leak proof / earthquake proof containers to prevent contamination of water supplies. Needs to be stored safely for a really long time as some waste contains isotopes with very long half-lives. Should be well away from people / buried deep underground. **5–6 marks** Comprehensive coverage of all 3 areas: description, properties and waste storage. *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.*	6			6		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
				3–4 marks Comprehensive coverage of 2 areas: description, properties and waste storage **or** limited description of all 3. *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.* **1–2 marks** Comprehensive coverage of 1 area: description, properties and waste storage **or** limited description of 1 or 2 areas. *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.* **0 marks** *No attempt made or no response worthy of credit.*						
	(b)			$^{235}_{92}\mathrm{U}\,(1) \rightarrow {}^{231}_{90}\mathrm{Th} + {}^{4}_{2}\alpha\,(1)$ $^{231}_{90}\mathrm{Th} \rightarrow {}^{231}_{91}\mathrm{Pa}\,(1) + {}^{0}_{-1}\beta\,(1)$	1 1	1 1		4		
				Question 4 total	**8**	**2**	**0**	**10**	**0**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		37 <u>years</u> Don't accept 37 light years Accept 1 169 200 000 <u>s</u> or 13 505 <u>days</u>	1			1		
		(ii)		Substitution: $3 \times 10^8 = \frac{d}{31\,600\,000 \times 37}$ **ecf** (1) Rearrangement: $d = 3 \times 10^8 \times 31\,600\,000 \times 37$ (1) $= 3.5 \times 10^{17}$ [m] (1) Award 2 marks for an answer of 9.48×10^{15} [m] Award 2 marks for an answer of 1.11×10^{10} [m]	1	1 1		3	3	
	(b)	(i)		**Any 2 × (1) from:** • Arcturus is <u>bigger</u> **or** has a <u>bigger radius</u> • Arcturus is <u>brighter</u> **or** <u>more luminous</u> • Arcturus is <u>cooler</u> **or** has a <u>lower temperature</u> Accept the converse answers. Don't accept reference to 'it'.		2		2		
		(ii)		Hydrogen reduces / hydrogen runs out / hydrogen fusion stops (1) Helium fusion begins (1) Increasing gas **or** radiation pressure (1) As outwards force is larger [than the inwards force] (1) Don't accept Sun has burnt all of its hydrogen	4			4		
				Question 5 total	**6**	**4**	**0**	**10**	**3**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)		Substitution: W = ½ × 0.15 ×12 (1) = 0.9 [J] (1)	1	1		2	2	
		(ii)		Substitution: 0.9 (**ecf**) = 0.5 × 0.075 × v^2 (1) Rearrangement: v^2 = 24 (1) v = 4.9 (1) m/s (1)	1 1	 1 1 		4	3	
		(iii)		Because some energy is lost (1) To {heat / friction / resistive forces} (1)	1	1		2		
	(b)			Substitution: 0.8 = F × 1.5 (1) $F = \frac{0.8}{1.5}$ (1) F = 0.5[3] [N] (1)	1	 1 1		3	3	
	(c)			[For the same extension] twice the force will be required (1) So ½ Fx will be double [so agree] (1)			2	2		
				Question 6 total	**5**	**6**	**2**	**13**	**8**	**0**

HIGHER TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	Marks Available					
	AO1	AO2	AO3	Total	Maths	Prac
1	2	0	3	5	0	0
2	0	5	5	10	5	10
3	3	7	2	12	5	0
4	8	2	0	10	0	0
5	6	4	0	10	3	0
6	5	6	2	13	8	0
Total	**24**	**24**	**12**	**60**	**21**	**10**