GCSE MARKING SCHEME

SUMMER 2018

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

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.

GCSE PHYSICS

SUMMER 2018 MARK SCHEME

UNIT 6: (Double Award) PHYSICS 2 (HIGHER TIER)

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)*			Ticks in 1st, 2nd and 3rd boxes 3 × (1) 4 boxes ticked maximum = 2 marks 5 boxes ticked maximum = 1 mark 6 boxes ticked = 0 marks	3			3		
	(b)			Beta emitters are most suitable as beta would be partly absorbed [Accept: beta will pass through thin Al / blocked by a few mm [or thick] Al] / alpha totally absorbed and gamma not absorbed (1) Increasing thickness decreases beta count rate [accept: changing thickness would change count rate] (1) Sr-90 has a long enough half-life so won't need frequent replacing / P-32 would need frequent replacing. (1) For 3 marks "agree" required.			3	3		
	(c)	(i)		It takes 29 years / this is the time to halve (1) number of nuclei / atoms / mass / amount / activity / count rate [of strontium-90] (1)	2			2		
		(ii)		[1 →] $\frac{1}{2}$ → $\frac{1}{4}$ → $\frac{1}{8}$ or [100] →50→25→12.5% (1) multiple halving ending with $\frac{1}{8}$ (12.5%) so $\frac{1}{8}$ is 3 half-lives **ecf** on incorrect halving or incorrect counting of half-lives (1) 3 **ecf** × 29 = 87 years (1) NB 87 years → 3 marks; 58 or 116 years → 2 marks		3		3	3	

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)	(i)		150 ÷ time (1) = 0.5 [cps] (1) ans		2		2	2	2
		(ii)		Measure for a longer period of time (1) take repeat readings (1)			2	2		2
				Question 1 total	**5**	**5**	**5**	**15**	**5**	**4**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	*(a)*	(i)		To ensure that the cake case has reached terminal [top / maximum….] speed / has stopped accelerating	1			1		1
		(ii)		To check repeatability / identify anomalies (1) [Not: to ensure there are no anomalies] To improve the mean / give a more accurate mean / to reduce the effect of random errors / to allow anomalies to be removed before calculating the mean (1) Reference to 'reliability' → no credit	2			2		2
	(b)	(i)		Substitution into $s = \frac{d}{t}$ i.e. $2.88 = \frac{1.50}{t}$ (1) t = 0.52 [s] (1) [accept 0.5, 0.521]	1	1		2	2	2
		(ii)		Appropriate scales on both axes 0.5 g and 0.5 m/s per 2 cm square (1) 5 points plotted correctly (ignore (0,0) to within <1 small square division (2) 4 points plotted correctly (ignore (0,0) to within <1 small square division (1) 3 points plotted correctly (ignore (0,0) to within <1 small square division (0) Smooth curve of best fit to (0,0) < 1 small square division (1)	1	1 1 1		4	4	4
		(iii)		Correct pair of values of speed taken from graph or table for 1.0 g and 2.0 g or 1.5 g and 3.0 g (1) Calculation of ratio for at least 1 other pair of masses e.g. ~2.8 / 1.60 = ~1.75 or 2.94 / 2.54 = 1.16 (1) Conclusion [must include a valid comparison of ratio to 1.4] – so not always true (1) **Alternative route** Correct pair of values of speed taken from graph or table for 1.0 g and 2.0 g or 1.5 g and 3.0 g (1) [can be implied by method] Calculation of expected speed, i.e. 2.54 × 1.4 = 3.56 or 2.24 × 1.4 = 3.14 (1) Valid comparison of speeds, e.g. 3.56 ≠ 2.94, or 3.14 ≠ 2.8 so not always true (1)			3	3	2	3

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			Valid improvement and justification e.g. Drop the cake cases from a greater height (1) So that the random errors due to timing are a smaller fraction of the value measured (1) **Alternative:** Use light gates / record with a camera or phone (1) to give a more accurate time measurement / reduce reaction time errors (1) **Alternative:** Measure the mass of the stack / each case (1) to give a more <u>accurate</u> mass / mass closer to the true value(1) Not: extra data collected			2	2		2
	(d)			**Use** of weight = mg (1) [allow even if mass not converted] air resistance = 0.025 [N] [on answer line] (1) **cao** air resistance = weight (1)	1	1 1		3	3	
				Question 2 total	**6**	**6**	**5**	**17**	**11**	**14**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3	*(a)*	(i)		**Either** Gas or radiation force/pressure and gravitational force / gravity (1) are balanced / equal **and** opposite / are in equilibrium (1) **Or** Outward force and inward force (1) are balanced / equal (1)	2			2		
		(ii)		Light from Spica will take 261 years to reach Earth (or v.v.) / this is the distance light travels in 261 years	1			1		
	(b)			**Indicative content:** **Properties** 1. Remainder of cycle: red giant → white dwarf… 2. Becomes larger, lower temperature / redder and brighter → smaller, higher temperature / whiter and dimmer. **Reactions** 3. Hydrogen fusion stops in centre of Sun and helium fusion starts – linked to red giant. 4. Helium fusion stops – no more fusion – linked to white dwarf. **Forces** 5. Red giant: Gas and radiation pressure in the core increases – linked to helium fusion – giving unbalanced forces and star expands 6. White dwarf: Gas and radiation pressure decreases when fusion stops causing star to shrink 7. End of red giant phase – outward forces cause outer layers to be blown away, contributing to a *planetary nebula,* leaving hotter core Other relevant points could be made – contributing to reactions or forces, e.g. • When H-fusion stops the core shrinks and heats up until a new balance of forces is established	3	3		6		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
				5 – 6 marks At least 5 points covered in all three aspects *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.* **3 – 4 marks** At least three points covered in two of the three aspects *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** Up to two points from any aspect. *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.*						
				Question 3 total	**6**	**3**	**0**	**9**	**0**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4	*(a)*			Acceleration is constant for 2 s (1) then decreases to zero (1)		2		2		
	(b)			Tangent drawn at a point between 4 s and 6 s(1) Calculation of acceleration from the line drawn **ecf** (1) [Do not accept 20 /5 = 4] [Expect 1.8 – 2.7] Unit m/s^2 correct (1)	1 1	1		3	2	
	(c)			Area of ½ base × height attempted (1) Answer of 22 m ± 1 m obtained (1)	1	1		2	2	
	(d)			Steeper line after 3 s [allow steeper from the start] (1) Either: Velocity flattens off at 27 m/s earlier than 11 s (1) Or Terminal velocity shown > 27 m/s (1) Or Velocity continues increasing above 27 m/s [may or may not plateau] (1)			2	2		
				Question 4 total	**3**	**4**	**2**	**9**	**4**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)			520 (1) × 31.6 (1) = 16 432 [km] 16 432 × 8.9 × 10^{-2} = 1 462.4 [kg] (1) answer **Alternatives** 10 × 31.6 = 316.0 (1) i.e. fuel in a week 316.0 × 8.9 × 10^{-2} = 28.124 (1) i.e. CO_2 in a week 28.124 × 52 = 1462.4 [kg] (1) ans 31.6 × 8.9 × 10^{-2}(1) CO_2 from 1 litre per week × 52 = 146.24 (1) CO_2 in a year from 1 litre per week × 10 = 1462.4 (1) CO_2 in a year from 10 litres per week **NOTES** × 10 **and** × 52 seen anywhere (1) 52 × 10 × 8.9 × 10^{-2} = 46.28 → 1 only		3		3	3	
	(b)			Reduce idling losses by having stop-start [system / buttons] (1) Reduce inertial losses by using low mass materials or regenerative braking (1) Reduce rolling resistance by using materials – or narrower tyres - which don't heat up as much as they are distorted **or** automatic tyre pressure warning system(1)	3			3		
	(c)			Calculation of KE: for 30 m/s = 522 000 J (1) KE for 10 m/s = 58 000 J (1) KE lost = ½ mv^2 – ½ mu^2 = 522 000 – 58 000 J KE lost = 464 000 [J] **ecf** on a slip (1) Energy transferred = 0.6 × 464 000 (**ecf** on an energy value) = 278400 [J] (1) NB using 20 m/s with ½ mv^2 → 232 000 J [→ 0 marks] → Energy transfer 139 200 J [→ 4th mark]	1	1 1 1		4	4	
				Question 5 total	**4**	**6**	**0**	**10**	**7**	**0**

HIGHER TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	Marks Available					
	AO1	AO2	AO3	Total	Maths	Prac
1	5	5	5	15	5	4
2	6	6	5	17	11	14
3	6	3	0	9	0	0
4	3	4	2	9	4	0
5	4	6	0	10	7	0
Total	24	24	12	60	27	18