GCSE MARKING SCHEME

SUMMER 2018

GCSE (NEW)
PHYSICS - UNIT 2 (FOUNDATION TIER)
3420U20-1

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

GCSE PHYSICS UNIT 2: FORCES, SPACE and RADIOACTIVITY (FOUNDATION 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.

<u>Marking abbreviations</u>

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

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
1	*(a)*			Boxes 3, 4 and 6 ticked (3) If 4 boxes are ticked, award a maximum of 2 marks If 5 boxes are ticked, award a maximum of 1 mark If all 6 boxes are ticked, award no marks	3			3		
	(b)			Big Bang	1			1		
				Question 1 total	**4**	**0**	**0**	**4**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	*(a)*			400 in first box (1) cao 200 in second box (1) cao		2		2		
	(b)	(i)		2		1		1		
		(ii)		One (1) Slow moving (1) Moderator (1) [Accept: fuel rods] Control rods (1)	4			4		
	(c)			**Reference to containment**: Concrete / steel drums / buried [deep] underground [or at sea] / must not leak **or** radiation is [very] penetrating [or equiv.] (1) **Reference to time**: half-lives are long / hundreds / thousands / millions / of years / takes a long time to decay [minimum 100 years if specified] / lasts a long time (1)	2			2		
				Question 2 total	**6**	**3**	**0**	**9**	**0**	**0**

Question				Marking details	AO1	AO2	AO3	Total	Maths	Prac
3		(i)		Similarity: They both have 2 [or the same number of] protons / 4 [or same number of] nucleons (1) Not: Both have a nucleus / have the same nucleus – treat as neutral Difference: <u>Helium atom</u> has [2] electrons (orbiting the nucleus)/ <u>alpha</u> has no electrons (1) Not: Reference to charge or size – treat as neutral	2			2		
		(ii)		206 (1) 82 (1)		2		2		
		(iii)		Po has an imbalance between the numbers of protons and neutrons [accept: has more neutrons than protons] / too many neutrons / it has an unstable <u>nucleus</u>	1			1		
		(iv)		<u>Alpha</u> particles are [accept: the radiation is] very ionising (1) Which kills cells / mutates cells or DNA [accept: causes cancer] (1) Not: radioactive / poisonous		2		2		
				Question 3 total	**3**	**4**	**0**	**7**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	*(a)*			5 points plotted correctly to within <1 small square division (2) 4 correct (1) 3 or less (0) Straight line drawn [within the range of points] with a ruler through the points <1 small square division from plotted points, avoiding the anomalous point (1)		3		3	3	3
	(b)	(i)		Reading taken from candidate's graph (eg. 5.0 [N]) [<1 small square tolerance]		1		1	1	1
		(ii)		Use of a pair of complementary values, e.g. m = 5.0 **ecf** from graph ÷ 2.0 (1) [<1 small square tolerance] = 2.5 [kg] (1) NB. Use of (4.0 N, 2.6 m/s^2) only credited for either mark if the candidate's graph passes through the point.	1	1		2	2	2
		(iii)		Straight(ish) line with smaller positive gradient (by eye) drawn always below the original one. NB does not need to pass through the origin but cannot meet the existing graph [except at the origin].		1		1	1	1

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			Possible answers: 2×3.2 [m/s^2] $= 6.4$ [m/s^2] (1) $\neq 5.6$ [m/s^2] so suggestion not correct (1) 16 [N]/ 5.6 [m/s^2] = 2.9 [kg] (1) $\neq 2.5$ [kg] **ecf** from (b)(ii), so suggestion not correct 16 [N] / 2.5 [kg] (ecf from (b)(ii)) = 6.4 [m/s^2] (1) $\neq 5.6$ [m/s^2] so suggestion not correct **Alternative:** Adding accelerations from forces adding up to 16 N, e.g. 4.8 + 0.8 + 0.8 = 6.4 (1) $\neq 5.6$ [m/s^2] so suggestion not correct (1) NB. Use of (4.0 N, 2.6 m/s^2) not penalised in this part, e.g. from 12 N + 4 N 4.8 [m/s^2] + 2.6 [m/s^2] = 7.4 [m/s^2] (1) $\neq 5.6$ [m/s^2] so suggestion not correct. (1) **Alternative:** Showing clearly that a different force, i.e. 14 N **ecf**, gives an acceleration of 5.6 m/s^2 (1) $\neq 16$ [N] so suggestion not correct (1)			2	2		
				Question 4 total	**1**	**6**	**2**	**9**	**7**	**8**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		Substitution: Moment = 2.0 × 50 [not: 2.0 × 0.5] (1) = 100 [N cm] (1) Do not accept 1.0 N m	1	1		2	2	2
		(ii)		Substitution: Distance = 100 (**ecf**) ÷ 2.5 (1) = 40 [cm] (1)	1	1		2	2	2
		(iii)		[For the moments to balance because] 1.5 N < 2.0 N [**or** the force on the right < the force on the left] (1)…. …… the distance [from the pivot] must be greater than 50 cm / beyond the end of the ruler [which is impossible]. (1)			2	2		2
	(b)			Substitution: Weight = 15 000 × 10 (1) = 150 000 [N] (1)	1	1		2	2	2
				Question 5 total	**3**	**3**	**2**	**8**	**6**	**8**

Question				Marking details	AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)		Kinetic	1			1		
		(ii)		127 500 [J]		1		1		
	(b)	(i)		Substitution: distance = $\dfrac{127\,500\,(\textbf{ecf})}{500\,000}$ (1) [allow 127 500 even if (a)(ii) answer incorrect.] = 0.255 m (1) [or 0.26 or 0.3]	1	1		2	2	
		(ii)	I	Crumple zone / <u>seat</u> belt / <u>air</u> bag (1)	1			1		
			II	They all decrease the force [on the driver] (1) by increasing the distance or time taken to come to rest / by decreasing the deceleration (1)		1 1		2		
				Question 6 total	**3**	**4**	**0**	**7**	**2**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
7	*(a)*		**Indicative content:**	3	3		6	3	

Section	Descriptions		
	Qualitative	**Numerical**	**Developed**
AB	Acceleration	0 to 25 m/s in 50 s	Constant acceleration (of 0.5 m/s^2)
BC	Constant velocity	25 m/s for 80 s	
CD	Deceleration	25 m/s to 0 in 70 s	Increasing deceleration
DE	Stationary	For 40 s	
EF	Acceleration	0 to 10 m/s in 60 s [or from 240 s – 300 s]	Constant acceleration less than AB (0.17 m/s^2)

5 – 6 marks
Correctly describes the whole motion with a good coverage of all three description areas
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
Gives a detailed description of the motion which involves two of the three description areas or a partial content of all three areas.
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.

Question			Marking details	AO1	AO2	AO3	Total	Maths	Prac
			1-2 marks Some relevant points made from any of the description 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)	(i)		Substitution: Momentum change = $10\,000 \times (25 - 0)$ (1) = $250\,000$ [kg m/s] (1)	1	1		2	2	
	(ii)		Substitution: $F = \dfrac{\Delta p}{t} = \dfrac{250\,000\,(\text{ecf})}{50}$ (1) $= 5\,000$ [N] (1) **Alternative:** $a = 25 \div 50 = 0.5$ [m/s^2] (1) $F = ma = 0.5$ **ecf** $\times 10\,000 = 5\,000$ [N] (1) [NB. ecf only on a <u>calculation</u> of acceleration, not on a change in velocity]	1	1		2	2	
	(iii)		Substitution: Distance = 25×80 (1) [No tolerance] $= 2\,000$ [m] (1)	1	1		2	2	
	(iv)		The line / it would be lower on the graph [than BC] (1) The length [of the line] would be greater [than 80 s] (1)			2	2	1	
(c)			Bigger mass / more inertia [not: heavier] (1) [so the same force] would produce a <u>smaller</u> [not: slower] acceleration (1)	2			2		
			Question 7 total	**8**	**6**	**2**	**16**	**10**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
8	(a)		Get other groups or different people [e.g. students] to carry out the experiment (1) If the data collected is similar [then it's reproducible] (1) [Independent mark]			2	2		2
	(b)		Drop number 2 or time = 1.10 seconds, identified. If two times identified → 0			1	1		1
	(c)		(1.48 + 1.52 + 1.54 + 1.46)/4 [**or** 6.00/4] (1) Without anomalous value **ecf** = 1.50 [s] (1) [Accept 1.5] Possible answers applying **ecf** 5.62 s → 1.41 s 5.58 s → 1.40 s 5.56 s → 1.39 s 5.64 s → 1.41 s If anomaly is included - award 1 mark for correct method/calculation [→ 1.42 s] [Accept 1.4]		2		2	2	2
	(d)		Substitution: (0 + 14.2) × 1.50(**ecf**) ÷ 2 (1) = 10.65 [m] (1) NB 1.4 s → 9.9 m, 1.42 s → 10.1 m	1	1		2	2	2
			Question 8 total	**1**	**3**	**3**	**7**	**4**	**7**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9	*(a)*	(i)		Boxes 2 and 3 ticked: (1) + (1) **Note** – for each extra tick subtract 1 mark. No negative mark.		2		2		
		(ii)		Kepler 11 has <u>same mass</u> as our Sun (1) Kepler 11 has [the most] <u>similar</u> temperature to our Sun (1) Each additional item of data stated − 1 (minimum 0)			2	2		
	(b)	(i)		The exoplanet blocks out / absorbs [some] light from the star Accept: there is a shadow / eclipse 'The planet doesn't give out light' – not enough	1			1		
		(ii)	I	2 orbits take 150 [days] or 300-150 [days] (1) Single orbit = $\dfrac{150}{2}$ = 75 [days] (1) [Accept 75 – 78 days] **Alternative** 4 orbits take 300 [days] (1) [accept 310 days] Single orbit = $\dfrac{300}{4}$ = 75 [days] (1) [Accept 75 – 78 days]			2	2	2	
			II	An extra/different dip in the intensity line is present [accept anomaly] Not: another transit shown			1	1		
			III	[An absorption spectrum arises because] gases absorb some light (1) Different gases [accept: elements] [in the planet's atmosphere] have <u>different</u> black lines / [absorb light at] different wavelength / frequencies . (1)	2			2		

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
(c)	(i)		In <u>both</u> systems the temperature decreases with distance / orbit radius (1) But In the Solar System Venus is the 2nd planet but the hottest / Mercury is the first and not the hottest (1) [i.e the nature of the anomaly must be made clear]			2	2		
	(ii)		0.25 – 0.26		1		1	1	
			Question 9 total	**3**	**3**	**7**	**13**	**3**	**0**

FOUNDATION TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	Total	Maths	Prac
1	4	0	0	4	0	0
2	6	3	0	9	0	0
3	3	4	0	7	0	0
4	1	6	2	9	7	8
5	3	3	2	8	6	8
6	3	4	0	7	2	0
7	8	6	2	16	10	0
8	1	3	3	7	4	7
9	3	3	7	13	3	0
Total	**32**	**32**	**16**	**80**	**32**	**21**