GCSE MARKING SCHEME

SUMMER 2022

GCSE
PHYSICS – UNIT 2 (HIGHER TIER)
3420UD0-1 (CONTINGENCY)

INTRODUCTION

This marking scheme was used by WJEC for the 2020 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 - UNIT 2

HIGHER TIER

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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.

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)	(i)		2.0 [kg m/s]		1		1		
		(ii)		Substitution: $\frac{2.0\ \mathbf{ecf}}{0.160}$ (1) = 12.5 [m/s] (1)	1	1		2	2	
		(iii)		0.0005 or 0.5×10^{-3} [s]		1		1		
		(iv)		Substitution: $\frac{2.0}{0.5 \times 10^{-3}\ \mathbf{ecf}}$ (1) = [-] 4 000 [N] (1) **Note-** Award 1 mark for answer 4 where n is not equal to 3	1	1		2	2	
	(b)	(i)		equal to (1) no (1)	2			2		
		(ii)		Straight diagonal line from (2.5, 0) $\rightarrow$(3.0, 2.0) (1) Straight horizontal line from (3.0, 2.0) $\rightarrow$ (5.0, 2.0) (1) Award 1 mark only for diagonal line starting from (2.5,0) to any point for a momentum of 2 followed by a horizontal line			2	2		
				Question 1 total	**4**	**4**	**2**	**10**	**4**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		The 3 readings are similar / the 3 readings are repeatable			1	1	0	1
		(ii)		$\frac{2.82}{3} = 0.94$ (1)		1		1	1	1
	(b)	(i)		**Ticks in boxes 2, 4 and 6** • Cake case 1 and 2 have identical weight (1) • At terminal speed, both cake cases experience identical values of air resistance (1) • At terminal speed, both cake cases have zero acceleration (1)		3		3		3
		(ii)		Terminal speed of CK1 is 1.6 and when doubled is 3.2 m/s (1) which isn't the same as 2.3 m/s for CK2 (1) [so prediction incorrect.] **Alternative:** Terminal speed of CK2 is 2.3 m/s and when halved is 1.15 m/s (1) which isn't the same as 1.6 m/s for CK1 (1) [so prediction incorrect.] **Alternative:** It is not doubled (1) It increases by 0.7 m/s (1) [so prediction incorrect.]			2	2	2	2
	(c)			**Ticks in boxes 2, 4 and 6** • The terminal speed after the parachute is opened is $\frac{1}{10}$th of the terminal speed before the parachute is opened (1) • The parachute is opened 30 s after the skydiver leaves the helicopter (1) • At point **A** the skydiver stops accelerating (1)	1	1 1		3	1	
				Question 2 total	**1**	**6**	**3**	**10**	**4**	**7**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)			The smallest scale division on ruler is [±]1 cm (1) [so correct]			1	1		1
	(b)	(i)		d_1 scale 5 cm/division **and** d_2 scale 2 cm per division (1) All 5 points plotted correctly ± < 1 small square tolerance (1) 4 or less points plotted correctly ± < 1 small square tolerance (0) [Best fit] straight line between 5 – 40 cm for d_1(1)		3		3	3	3
		(ii)		Gradient = $\frac{16}{40}$ ((1) selection of pair of values) alternatives accepted = 0.4 (1) $\frac{W_1}{W_2} = \frac{4}{10}$ (1) [so Mary is correct] Full marks can be awarded for this part if axes are plotted the wrong way round. Answer only of 0.4 award 1 mark only			3	3	3	3
	(c)	(i)		Substitution: 10 × 32 (1) = 320 [N cm] (1)	1	1		2	2	2
		(ii)		Anticlockwise moment = 320 = 4 × d_1 d_1 = $\frac{320}{4}$ = 80 [cm] (1) Ruler not long enough **or** 80 cm > distance from pivot to ruler end **or** greater than 50 cm [so can't be balanced] (1) **Alternative:** maximum anticlockwise moment = 4 × 50 = 200 [N cm] (1) clockwise moment 320 N cm > maximum anticlockwise moment 200 N cm **or** 120 less than needed [so can't be balanced] (1)		2		2	2	2
				Question 3 total	**1**	**6**	**4**	**11**	**10**	**11**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		190 + 190 + 290 + 240 (1) [= 910 km]	1			1	1	
		(ii)		Substitution of either: April: $\text{speed} = \frac{\text{distance}}{\text{time}} = \frac{910}{31.5}$ **or** $\text{speed} = \frac{\text{distance}}{\text{time}} = \frac{610}{19.25}$ (1) April = 28.9 [km/h] (1) June = 31.7 [km/h] (1) [Conclusion - mean speed in June / 31.7 km/h is larger than April / 28.9 km/h so statement correct]			3	3	3	
	(b)	(i)		Substitution: $42 = 8.0 \times 3 + 0.5 \times a \times 3^2$ (1) So: $42 = 24 + 4.5a$ Rearrangement; $a = \frac{42 - 24}{4.5} = \frac{18}{4.5}$ (1) = 4 (1) m/s^2 (1)	1 1	1 1		4	3	
		(ii)	I	Substitution: $F = ma$ i.e. 284 = $m \times 4$ (**ecf**) (1) $m = \frac{284}{4}$ = 71 [kg] (1)	1	 1		2	2	
			II	71 (**ecf**) – 64.5 = 6.5 [kg]		1		1	1	
				Question 4 total	**4**	**4**	**3**	**11**	**10**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		Its temperature increases [to point Y] (1) and then [from Y to white dwarf] its temperature decreases (1)		2		2		
		(ii)		Its brightness decreases **or** it gets dimmer		1		1		
	(b)			[Main sequence $\rightarrow$] super giant (1) $\rightarrow$ supernova (1) $\rightarrow$ black hole **or** neutron star (1)	3			3		
	(c)			$8.6 \times 63\,241 = 543\,872.6$ [AU] (1) $543\,872.6$ (**ecf**) $\times 1.5 \times 10^{8} = 8.158 \times 10^{13}$ [km] (1) $8.158 \times 10^{13} \times 1\,000$ (1 - conversion) $= 8.158 \times 10^{16}$ [m] For an answer of 8.2×10^{n} where n is not equal to 16 award 2 marks		3		3	3	
				Question 5 total	**3**	**6**	**0**	**9**	**3**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)			[Very] high temperature (1) [Very] high pressure (1) Don't accept heat	2			2		
	(b)	(i)		Line drawn at 590 nm	1			1		
		(ii)		Longer wavelength / red shifted / moved to the right side (1) More distant star moving away from Earth (1) so its wave is stretched (1)	3			3		
				Question 6 total	**6**	**0**	**0**	**6**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)			2	1			1		
	(b)	(i)		Slows down the neutrons (1) which enables the fission reaction to happen (1)	2			2		
		(ii)		Fission reaction [in fast breeder] happens with fast neutrons / no need to slow neutrons down for fission reaction [so moderator not needed]			1	1		
	(c)			**Indicative content:** **Advantages** 1. Underground storage ensures a large distance between HLW and people. 2. Ionising radiation absorbed by the Earth so reduces exposure to people living on the surface. 3. Glass / containers / concrete are stable for thousands of years which reduces the risk of HLW leaking. 4. Employment for scientists/security workers etc who work at the HLW storage facility. 5. Easy to monitor the HLW during long term storage. **Disadvantages** 1. Need stable geological area to ensure HLW storage is safe. 2. Costly to construct, monitor and ensure high security of deep underground HLW storage area. 3. HLW has long half-life so storage facility needs to operate for 1000's of years. 4. Safety and security risks associated with transporting HLW to the storage facility. 5. NIMBY concerns.	6			6		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				5–6 marks Detailed description of at least 3 advantages **and** 3 disadvantages. *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** A brief description of 2 advantages **and** 2 disadvantages. *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** A very brief description of either 1 or 2 advantages **or** 1 or 2 disadvantages **or** 1 advantage **and** 1 disadvantage. *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 7 total	**9**	**0**	**1**	**10**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)	(i)		10.5 – 4.5 = 6.0 [cm]		1		1	1	1
		(ii)		Weight of toy = 3.0 [N] (1) from graph / leaflet Division by 10 (1) $m = \frac{3.0}{10}$ = 0.3 [kg] (1)	1	1 1		3	3	3
	(b)	(i)		If object A exerts a force on object B, then object B exerts an equal (1) and opposite force on object A (1) **Alternative:** Action and reaction force are equal (1) and opposite (1)	2			2		2
		(ii)		4 [N] (1) Up (1)		2		2		2
	(c)	(i)		Substitution: W = 0.5 × 35 × 0.32 (1) = 5.6 [J] (1)	1	1		2	2	
		(ii)		[Force doubles **or** force is 70 N and] the extension doubles **or** extension is 0.64 m **or** the work done is 11.2 [J] **ecf** (1) W = 0.5 × 70 × 0.64 = 22.4 [J] or implied (1) which is 4 times the WD **or** which isn't double **or** which isn't 11.2 [J] **ecf** (1) so the gym instructor is not correct. Conclusion must be present to award 3 marks			3	3	3	
				Question 8 total	**4**	**6**	**3**	**13**	**9**	**8**

HIGHER TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	Marks Available					
	AO1	AO2	AO3	Total	Maths	Prac
1	4	4	2	10	4	0
2	1	6	3	10	4	7
3	1	6	4	11	10	11
4	4	4	3	11	10	0
5	3	6	0	9	3	0
6	6	0	0	6	0	0
7	9	0	1	10	0	0
8	4	6	3	13	9	8
Total	**32**	**32**	**16**	**80**	**40**	**26**