GCSE MARKING SCHEME

SUMMER 2022

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

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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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WJEC GCSE PHYSICS – UNIT 2

FOUNDATION TIER

SUMMER 2022 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.

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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

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
1.	(a)	(i)		Gravity	1			1		
		(ii)		Pressure	1			1		
	(b)	(i)		Supergiant (1) Neutron star (1)	2			2		
		(ii)		Space (1) Solar system (1)	2			2		
				Question 1 total	**6**	**0**	**0**	**6**	**0**	**0**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2.	(a)			6 points plotted correctly to within <1 small square division (2) 5 points plotted correctly to within <1 small square division (1) 4 or less points plotted correctly to within <1 small square division (0) Straight line of best fit from plotted points (1) N.B. doesn't need to extend to the x-axis		3		3	3	3
	(b)	(i)		10 ± 1 [cm] Don't accept 0		1		1	1	1
		(ii)	I	16 ± 1 [cm]		1		1	1	1
			II	6 [cm] **ecf** i.e. difference between previous 2 answers Don't accept negative answer		1		1	1	1
		(iii)		Substitution: $\frac{3}{6}$ **ecf** (1) Spring constant = 0.5 [N/cm] (1)	1	1		2	2	2
		(iv)		Stays the same		1		1	1	1
				Question 2 total	**1**	**8**	**0**	**9**	**9**	**9**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3.	(a)			Substitution: moment = 80 × 0.25 (1) = 20 [N m] (1)	1	1		2	2	
	(b)			Greater distance **or** longer distance (1) so moment will be greater **OR** less force [for same moment] (1) Accept relevant numerical data (1) with explanation (1) Accept longer length Don't accept longer spanner or reference to momentum			2	2		
				Question 3 total	**1**	**1**	**2**	**4**	**2**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4.	(a)			[Very] <u>high</u> temperatures (1) [Very] <u>high</u> pressures (1) Don't accept heat	2			2		
	(b)			$^{4\ (1)}_{2\ (1)}\mathrm{He} + {}_{0\ (1)}^{1}\mathrm{n}$	1	2		3		
				Question 4 total	**3**	**2**	**0**	**5**	**0**	**0**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5.	(a)	(i)		X - weight (1) accept force of gravity **or** gravitational Y – air resistance (1) accept drag	2			2		
		(ii)		X – stays the same (1) Y – increases (1)	2			2		
	(b)	(i)		Smaller than		1		1		
		(ii)		Equal to		1		1		
	(c)	(i)		Substitution: v = [0 +] (10 $\times$ 2) (1) = 20 [m/s] (1)	1	1		2	2	
		(ii)		Selection of: $x = \frac{(u+v)}{2}t$ (1) can be implied Substitution: $\frac{([0+]\,20\ \textbf{ecf})}{2}$ x 2 (1) = 20 [m] (1)	1 1	 1		3	3	
				Question 5 total	**7**	**4**	**0**	**11**	**5**	**0**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6.	(a)	(i)		Remove all dice with 6 [facing up] **or** count all dice with 6 [facing up] Accept remove all decayed nuclei	1			1		1
		(ii)		Throw remaining dice again **or** repeat with remaining dice **or** remove the sixes and repeat Accept throw the dice that are left **or** keep throwing the dice taking out sixes every time	1			1		1
		(iii)	I	1 in 6 **or** $\frac{1}{6}$ **or** equivalent fraction e.g. $\frac{40}{240}$ Accept 16.67 % **or** 17 % **or** 0.167		1		1	1	1
			II	40 **ecf**		1		1	1	1
	(b)	(i)		172		1		1	1	1
		(ii)		120 Don't accept 122		1		1	1	1
		(iii)		4 [throws] **ecf** Don’t accept with ecf any answer above 5 **or** 4.1 [throws]		1		1	1	1
				Question 6 total	**2**	**5**	**0**	**7**	**5**	**7**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7.	(a)	(i)		30 [m/s]		1		1	1	
		(ii)		Substitution: $\frac{30\ \textbf{ecf}}{1.5}$ (1) = 20 [m/s^2] (1)	1 1			2	2	
	(b)	(i)		**Indicative content** AB – During the first 2.5 s there is uniform / constant acceleration from 0 to 40 m/s. BC – Between 2.5 and 3 s there is uniform / constant deceleration from 40 to 20 m/s. CD – After 3 s the car travels at constant speed of 20 m/s for 1 second. **5–6 marks** Comprehensively describes all three parts of the motion in detail and includes all values relevant to the motion. *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** Comprehensively describes two of the parts of the motion in detail with some values **or** limited description of all three parts with some values included. *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.*	3	3		6	3	

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				1–2 marks Gives a limited description of one or two parts of the motion **or** description given of all parts with no data included. *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.*						
		(ii)		$\text{speed} = \frac{\text{distance}}{\text{time}}$ or implied (1) Substitution: $\text{speed} = \frac{85}{4}$ (1) Speed = 21.25 or 21.3 or 21 [m/s] (1)	1	1 1		3	3	
				Question 7 total	**5**	**7**	**0**	**12**	**9**	**0**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8.	(a)	(i)		Expanding	1			1		
		(ii)		A single point	1			1		
	(b)	(i)		**Any 2 ×(1) from:** - same number in both - same pattern or accept same distance apart - red shifted <u>in B</u> / shifted to the right <u>in B</u> / longer wavelengths <u>in B</u>. Accept closer to the left <u>in A</u> or shorter wavelengths <u>in A</u>			2	2		
		(ii)		X is further away (1) X is moving faster (1) Accept converse and diagram B for X			2	2		
				Question 8 total	**2**	**0**	**4**	**6**	**0**	**0**

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<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>9.</td><td>(a)</td><td></td><td></td><td>Alpha – <u>helium nucleus</u> (1) Treat 2 protons and 2 neutrons as neutral
Beta – [fast moving] electron (1)
Gamma – em wave (1)</td><td>3</td><td></td><td></td><td>3</td><td></td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td></td><td>$\frac{18}{30}$ = 0.6 [counts per second]</td><td></td><td>1</td><td></td><td>1</td><td>1</td><td>1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>Measure for longer (1)
Repeat (1)</td><td></td><td></td><td>2</td><td>2</td><td></td><td>2</td></tr>
<tr><td></td><td></td><td>(iii)</td><td></td><td>[More] radon (1)
Due to granite or different types of rock (1)

Alternative:
[More] cosmic rays (1)
Due to high altitude (1)</td><td>2</td><td></td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td></td><td>
<table>
<tr><td></td><td>Alpha</td><td>Beta</td><td>Gamma</td></tr>
<tr><td>Source 1</td><td>N</td><td>N</td><td>Y</td></tr>
<tr><td>Source 2</td><td>Y (1)</td><td>Y (1)</td><td>N (1)</td></tr>
</table>
Award 1 mark for source 1 row being correct
Accept ticks and crosses for Y and N</td><td></td><td></td><td>4</td><td>4</td><td></td><td>4</td></tr>
</table>

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		Lead or concrete [absorber] should be included (1) To confirm that gamma [is emitted] (1) **OR** Reduce distance between source and detector (1) To detect alpha (1) **OR** Use thick aluminium (1) To confirm no beta is emitted by source 1 (1)			2	2		2
				Question 9 total	**5**	**1**	**8**	**14**	**1**	**9**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
10.	(a)	(i)		Ticks in boxes 3 and 4 i.e. A year on Earth is about 4 times longer than a year on Mercury. Mercury orbits the Sun with a speed around 10 times greater than Pluto. N.B. Deduct 1 mark for each additional tick		2		2		
		(ii)		Pluto has the smallest mass **or** Pluto has the smallest diameter **or** Pluto is smaller than our moon Accept relevant use of data **or** Pluto is much smaller than the other planets		1		1		
		(iii)		Distance between 1.53 and 5.19 [units]		1		1	1	
	(b)			Earth has largest mass (accept biggest) (1) and shortest day [so agree] (1) **OR** Mercury has smallest mass (1) and longest day [so agree] (1) **OR** Mars and Earth have similar day length (1) and Earth has [much] bigger mass [so disagree] (1) **OR** Venus has larger mass (1) and [much] longer day than Mars [so disagree] (1) **OR** Venus and Earth have a similar mass (1) But Venus has [much] longer day [so disagree] (1)			2	2	1	

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				Accept the following: Earth has largest mass [of the rocky planets] (1) but Jupiter/gas giants have shortest day length [so disagree] (1) **OR** Jupiter is not a rocky planet / is a gas giant / the gas giants (1) but has (have) the shortest day length [so disagree] (1) N.B. Only award marks for reference to day length on Jupiter if it is clear that there is a comparison to rocky planets. **Do not accept** Jupiter has the shortest day length alone.						
				Question 10 total	**0**	**4**	**2**	**6**	**1**	**0**

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SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	Total	Maths	Prac
1	6	0	0	**6**	0	0
2	1	8	0	**9**	9	9
3	1	1	2	**4**	2	0
4	3	2	0	**5**	0	0
5	7	4	0	**11**	5	0
6	2	5	0	**7**	5	7
7	5	7	0	**12**	9	0
8	2	0	4	**6**	0	0
9	5	1	8	**14**	1	9
10	0	4	2	**6**	1	0
Total	**32**	**32**	**16**	**80**	**32**	**25**

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