GCSE MARKING SCHEME

SUMMER 2024

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

About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

WJEC GCSE PHYSICS

UNIT 2 – FORCES, SPACE AND RADIOACTIVITY

FOUNDATION TIER

SUMMER 2024 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)			Kinetic energy → Ball held above the ground Elastic energy → Stretched rubber band Gravitational potential energy → Ball rolling along level ground 3 correct – 2 marks 1 or 2 correct – 1 mark	2			2		
	(b)	(i)		Work done = 2 × 100 (1) Work done = 200 [J] (1)	1	1		2	2	
		(ii)		200 **ecf** (1) J **or** N m (1)	2			2		
				Question 1 total	**5**	**1**	**0**	**6**	**2**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		Fusing	1			1		
		(ii)		Balanced	1			1		
	(b)	(i)		Protostar (1) Supergiant (1) Neutron star (1)	3			3		
		(ii)		Tick in box 2 i.e. Heavy elements are returned to space	1			1		
				Question 2 total	**6**	**0**	**0**	**6**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)		Increase (1) Momentum (1) Decreases (1)	3			3		
		(ii)		Crumple zone / seat belt / roll cage / side impact bars / child safety seat / head rests Accept child locks Don't accept any reference to brakes / tyres	1			1		
	(b)			This reduces {air resistance / drag} (1) Don't accept wind resistance Making the car [more energy] efficient **or** to reduce fuel costs (1) Accept allows the car to go fast	2			2		
				Question 3 total	**6**	**0**	**0**	**6**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		550 - 555		1		1	1	
		(ii)		[Galaxy] D (1) [The absorption lines] {have the greatest red shift / longest wavelength / moved most to the right / red} (1)		2		2		
		(iii)		[The universe is] expanding / started with the Big Bang Accept started at a single point Don't accept it's moving away		1		1		
	(b)			[Only] helium is present **or** there is no iron present (1) [Only] line at 587 [units] **or** there is no line at 527 [units] (1)			2	2		
				Question 4 total	**0**	**4**	**2**	**6**	**1**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		Momentum = 40 × 2 (1) Momentum = 80 [kg m/s] (1)	1	1		2	2	
		(ii)		150 + 80 (**ecf**) = 230 [kg m/s]		1		1		
		(iii)		230 (**ecf**) [kg m/s]	1			1		
		(iv)		Velocity = $\frac{230\ \textbf{ecf}}{90}$ (1) Velocity = 2.56 **or** 2.6 [m/s] (1) Answer only of 2.5 **or** 2.55 [m/s] award 1 mark	1	1		2	2	
		(v)		x = ½ (2.56 (**ecf**) + 0) × 25 (1) x = 32 [m] (1) Answer only of 33 [m] award 2 marks	1	1		2	2	
	(b)			Abi's momentum {doubles / is 300 [kg m/s]} (1) Rachel's momentum {stays same / is 80 [kg m/s] / hasn't doubled} **or** Rachel's velocity hasn't doubled (1) [so incorrect] Accept total momentum = 380 [kg m/s so disagree] (2) Award 2 marks for to double the total momentum {Rachel's / both} velocities must double			2	2		
				Question 5 total	**4**	**4**	**2**	**10**	**6**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)			[9 + 14 =] 23 [m] (1)		1		1		
	(b)			As the speed increases, the thinking distance increases (1) {at a constant rate / linearly / proportionately} (1) **Or** Thinking distance is proportional to speed (2) **Or** If the speed doubles, the thinking distance doubles OWTTE (2) **Or** For every 10 mph increase in speed, thinking distance increases by 3 m (2) Treat as neutral any reference to braking distance		2		2	2	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			**Indicative content:** Thinking distance is the distance travelled in the driver's reaction time. Braking distance is the distance travelled while braking. Factors: Thinking distance is affected by alcohol, drugs, tiredness, use of mobile phone and the speed of the car. Braking distance is affected by the condition of the road, the condition of the brakes and tyres and the speed of the car. **5 – 6 marks** Correctly describes what is meant by both distances and gives some correct examples of the factors affecting each of them. *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** Correctly describes what is meant by one of the distances and gives correct examples of the factors affecting that distance **OR** gives a partial description of both with some factors. *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** Correctly describes what is meant by one of the distances **OR** gives correct examples of the factors affecting that distance **OR** gives some factors that can affect either distance. *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.*	6			6		
				Question 6 total	**6**	**3**	**0**	**9**	**2**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)	(i)		4 (1) 2 (1)		2		2	2	
		(ii)		1 (1) 1 (1) 1 (1) 2 (1)		4		4		
		(iii)		[Very] high temperatures (1) [Very] high pressures (1) Accept hard to contain Don't accept heat	2			2		
	(b)	(i)		3		1		1		
		(ii)		Moderator / graphite Accept water	1			1		
		(iii)		So neutrons can be absorbed [by other uranium nuclei] **or** to cause fission	1			1		
		(iv)		To absorb neutrons **or** to stop the reaction getting out of control **or** to control the {speed / temperature} of the reaction OWTTE	1			1		
				Question 7 total	**5**	**7**	**0**	**12**	**2**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)	(i)		$75 \times 16 = 1200$ [MBq]		1		1	1	
		(ii)		Halving 1200 (**ecf**) **or** 16 at least once (1) 1200 (**ecf**) $\times$ ½ $\times$ ½ = 300 [MBq] (1)		2		2	2	
	(b)			Too short a half-life **or** decays too quickly **or** doesn't last long enough **or** pellet would need replacing (1) so wouldn't kill enough [cancer] <u>cells</u> (1)		2		2		
				Question 8 total	**0**	**5**	**0**	**5**	**3**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9	(a)	(i)		Aberystwyth has less radon than Penzance but more than Chester (1) OWTTE and the pie chart for location A has less radon than location C but more than location B (1) [so Adam is correct]			2	2		
		(ii)	I	$\frac{30}{60}$ = 0.5 [cps]		1		1	1	1
			II	15		1		1	1	1
		(iii)		Man-made sources are only 14.3% or 14.5% (1) this is lower than natural sources (1) ORA so disagree Conclusion must be present to award both marks **OR** Radon [is a natural source and it] is 50% (1) So man-made sources can't be more than 50% (1) so disagree Conclusion must be present to award both marks **OR** Correctly named sources of natural radiation are stated with percentage stated (1) So there is a larger proportion from natural sources (1) so disagree Conclusion must be present to award both marks			2	2		
	(b)	(i)		Attempt at adding her total dose (1) Total dose is 2.7 + 0.18 + 2 $\times$ 0.09 + 0.005 + 6.6 = 9.665 [units] [this is less than 20] so it is still safe [for her to work with radiation] (1)			2	2	1	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		{16 hours of flying / 2 flights} (1) gives the same [exposure] as a power station worker [gets in one year] (1) [so disagree] **OR** 3 or more flights **or** more than 24 hours of flying (1) gives more [exposure] than a power station worker [gets in one year] (1) [so disagree] Accept: In 1 year airline pilots receive 32.85 [units] (1) gives more [exposure] than a power station worker [gets in one year] (1) [so disagree]			2	2		
				Question 9 total	**0**	**2**	**8**	**10**	**3**	**2**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
10	(a)	(i)		[Freya is incorrect,] there is an anomaly (1) and should not be included (1) Award 1 mark for $\frac{7.6+8.0}{2} = 7.8$ [s]			2	2	1	2
		(ii)		Data is not repeatable because repeats are quite far apart (1) **OR** It is repeatable because the repeats are close to each other (1) **OR** It is repeatable apart from 20 cm (1)			1	1		1
	(b)			Timing [moving object] **or** reaction time **or** difficult to {start / stop} the stopwatch on time (1) Accept human error only if qualified Use a slow-motion camera **or** increase the distance travelled (1) accept record it / video it / light gates. Don't accept use lasers or use your phone Accept reference to keeping the volume of oil constant OWTTE		1	1	2		2
	(c)	(i)		Between 6.8 [s] and 7.2 [s]		1		1	1	1
		(ii)		$\frac{53-30}{12-9}$ (1) = 7.67 **or** 7.7 [cm/s] (1)		2		2	2	2
		(iii)		Decreases (1) To zero (1) **Alternative:** Starts high (1) Then it stops accelerating (1)		2		2		2
				Question 10 total	**0**	**6**	**4**	**10**	**4**	**10**

FOUNDATION TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	Total	Maths	Prac
1	5	1	0	6	2	0
2	6	0	0	6	0	0
3	6	0	0	6	0	0
4	0	4	2	6	1	0
5	4	4	2	10	6	0
6	6	3	0	9	2	0
7	5	7	0	12	2	0
8	0	5	0	5	3	0
9	0	2	8	10	3	2
10	0	6	4	10	4	10
Total	**32**	**32**	**16**	**80**	**23**	**12**