GCSE MARKING SCHEME

SUMMER 2019

PHYSICS UNIT 2 FOUNDATION (SEPARATE AWARD)
3420U20-1

© WJEC CBAC Ltd.

INTRODUCTION

This marking scheme was used by WJEC for the 2019 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.

© WJEC CBAC Ltd.

GCSE PHYSICS

UNIT 2: FORCES, SPACE and RADIOACTIVITY

FOUNDATION TIER

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.

© WJEC CBAC Ltd.

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

© WJEC CBAC Ltd.

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
1	*(a)*			Ticks in boxes 2, 4 & 5 (-1 for each additional box ticked) (3) The further away a galaxy is the longer the wavelength of the dark lines (✓) The dark lines can be used to identify the elements present in the star / galaxy (✓) The dark lines in the spectra from distant galaxies are red shifted (✓)	3			3		
	(b)			CMBR / cosmic microwave background radiation	1			1		
				Question 1 total	**4**	**0**	**0**	**4**	**0**	**0**

© WJEC CBAC Ltd.

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	*(a)*	(i)		Substitution: $W = F \times d$ = 50 000 × 20 (1) W = 1 000 000 [J] (1)	1	1		2	2	
		(ii)		[Energy transfer = 1 000 000 (**ecf**) – 600 000] = 400 000 [J] N.B. Don't award the **ecf** mark if negative energy calculated or if subtracted incorrectly		1		1	1	
	(b)			**Any 2 × 1:** Make it [more] streamlined / using materials in tyres which don't heat up [as much] **or** lower profile tyres / stop – start systems / use lighter materials / automatic tyre pressure warnings / eco system / regenerative braking **or** hybrid **or** electric cars Don't accept smaller car or smaller engine	2			2		
				Question 2 total	**3**	**2**	**0**	**5**	**3**	**0**

© WJEC CBAC Ltd.

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3	*(a)*			Substitution: Momentum of 1 = 50 × 5 (1) Substitution: Momentum of 2 = 30 × [-]1 (1) Total momentum = 250 – 30 = 220 [kg m/s] (1) Answer of 280 award 2 marks Answer of 250 or 30 award 1 mark	1 1	1		3	3	
	(b)			Velocity = $\frac{220(\textbf{ecf})}{80}$ (1) Velocity = 2.75 [m/s] (1) If **ecf** on 280 answer is 3.5 [m/s]	1	1		2	2	
				Question 3 total	**3**	**2**	**0**	**5**	**5**	**0**

© WJEC CBAC Ltd.

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4	*(a)*	(i)		[For a body in equilibrium the sum of] the clockwise moments = [the sum of] the anticlockwise moments [about the same point]	1			1		1
		(ii)		Substitution: moment = 2×40 (1) Moment = 80 [N cm] (1)	1	1		2	2	2
		(iii)		Distance = $\frac{80(\textbf{ecf})}{5}$ (1) Distance = 16 [cm] (1)	1	1		2	2	2
	(b)			Moment will double (1) so the distance [from the pivot] needs to double so she is wrong (1) **Alternative** $4 \times 40 = 160$ [N cm] (1) so the distance [from the pivot] needs to double **or** is 32 cm so she is wrong (1) To award full marks the correct conclusion needs to be present			2	2		2
				Question 4 total	**3**	**2**	**2**	**7**	**4**	**7**

© WJEC CBAC Ltd.

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5	*(a)*			137 (1) 55 (1)		2		2		
	(b)	(i)		Neutron don't accept the symbol	1			1		
		(ii)		Only <u>one</u> neutron causes further fission **or** the other <u>two</u> can't produce further fission (1) To prevent uncontrolled <u>chain</u> reaction **or** to prevent overheating **or** to prevent meltdown / to control the <u>chain</u> reaction (1) or converse argument. Don't accept to stop the chain reaction or to stop an explosion	2			2		
	(c)			**Any 2 ×(1):** - It is radioactive for a long time **or** products have long half-lives - It is ionising - It is penetrating	2			2		
	(d)	(i)		It is 0.3 % / it is a very small % / one of the smallest parts Don't accept it's the smallest		1		1		
		(ii)		Nuclear decay is a random process (1) Take measurements over a long time [so second group is better] **or** the <u>second group's results</u> are more accurate **or** the <u>second group</u> can calculate a mean (1)	2			2		2
				Question 5 total	**7**	**3**	**0**	**10**	**0**	**2**

© WJEC CBAC Ltd.

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
6	*(a)*	(i)		10 [cm]		1		1		1
		(ii)		35 cm read from graph (1) or implied 35 – 10 (**ecf**) = 25 cm (1) Answer of 35 [cm] anywhere award 1 mark Don't accept an answer of 10 [cm]		2		2		2
		(iii)		$k = \frac{2.5}{0.25(\textbf{ecf})}$ (1) conversion + substitution k = 10 [N/m] (1) If **ecf** on 35 answer is 7 [N/m] award 2 marks Answer of 0.1 **or** 0.07 [N/m] award 1 mark		2		2	2	2
	(b)			Steeper straight line beginning at same point i.e. (10, 0) (1) With twice the gradient through point (30, 4.0) (1)		2		2	1	2
				Question 6 total	**0**	**7**	**0**	**7**	**3**	**7**

© WJEC CBAC Ltd.

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
7	*(a)*			Hydrogen (1) Helium (1) Balanced with (1)	3			3		
	(b)			**Indicative content:** **Common to both** Both stars began from a cloud of gas and dust. As the cloud collapsed a protostar formed which then developed into a main sequence star. **Sun** The Sun will eventually become a red giant and then a white dwarf. **More massive star** The more massive star will stay on the main sequence for a shorter time before it becomes a supergiant. It will then explode in a supernova, ejecting heavy elements into space. What remains will either be a neutron star or, if the star was massive enough to begin with, a black hole. **5-6 marks** All the main stages in the life cycle are named correctly for both stars. *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 the life cycle of 1 of the stars or attempts both with a few omissions. *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.*	6			6		

© WJEC CBAC Ltd.

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
				1-2 marks Mentions some stages in the life cycle of 1 of the stars. *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**	**0**	**9**	**0**	**0**

© WJEC CBAC Ltd.

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
8	*(a)*			Air resistance and weight (1) Don't accept gravity or mass are equal and opposite / balanced / resultant force is zero (1)		2		2		2
	(b)	(i)		0.72			1	1		1
		(ii)		Mean time = $\frac{8.42}{7}$ (1) = 1.2[0 s] (1) award 1 mark for an answer of 1.14 arising from including anomaly		2		2	2	2
		(iii)		Speed = $\frac{1.5}{1.2}$ (**ecf**) = 1.25 [m/s] accept 1.3 [m/s] [1.32 m/s if mean given as 1.14]		1		1	1	1
	(c)	(i)		Mass / weight / number [of cake cases] Don't accept amount of cake cases	1			1		1
		(ii)		Size (or mass or type) of <u>cake case</u> / <u>drop</u> height Accept same cake case	1			1		1
		(iii)		Time over a greater distance (1) to reduce effect of random errors (1) **OR** Use light gates and data logger / record with [slow motion] camera (1) Don't accept lasers or computers to reduce uncertainties in the measurements / reduce human errors (1) **OR** Weigh a larger number of cake cases / each cake case (1) to reduce uncertainties in the mass (1)			2	2		2

© WJEC CBAC Ltd.

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)			When mass is 0.5 g speed = 1.125 accept 1.1 or 1.15 [m/s] (1) When mass is 1.0 g speed = 1.65 accept 1.55 [m/s] (1) **OR** When mass is 1.0 g speed = 1.65 accept 1.55 [m/s] (1) When mass is 2.0 g speed = 2.25 accept 2.35 [m/s] (1) **For the 3rd mark:** Calculate a ratio correctly and make a conclusion			3	3		3
				Question 8 total	**2**	**5**	**6**	**13**	**3**	**13**

© WJEC CBAC Ltd.

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
9	*(a)*	(i)		Straight line through origin shows a proportional relationship (1) so true for thinking distance but not braking distance (1) **OR** Braking distance is a curve so it isn't true (1) Thinking distance is a straight line through the origin so true (1) Accept answers based on data			2	2		
		(ii)		40 mph converted to 18 m/s (1) Distance of 12 [m] seen anywhere (1) Answer = 0.67 [s] (1) Award 2 marks for an answer of 0.3 [s]	1	1 1		3	3	
		(iii)		<table><tr><td>Speed (mph)</td><td>0</td><td>20</td><td>30</td><td>40</td><td>60</td><td>70</td></tr><tr><td>Total stopping distance (m)</td><td>**0**</td><td>**12**</td><td>**22 or 22.5 or 23**</td><td>**36**</td><td>**72 or 72.5 or 73**</td><td>**95 or 95.5 or 96**</td></tr><tr><td colspan="7">5 or 6 correct (2) 3 or 4 correct (1) 1 or 2 correct (0)</td></tr></table>		2		2	2	
		(iv)		5 points plotted correctly (ignore (0,0) ±< 1 small square (2) **ecf on table** 4 points plotted correctly ±< 1 small square (1) 3 or less points plotted correctly ±< 1 small square (0) Best fit curve **through (0,0)** ±< 1 small square (1) Don't accept double, thick, disjointed, whispy curves		3		3	3	
	(b)			At 30 mph stopping distance = 22 **or** 22.5 m **or** 23 m (**ecf**) (1) At 20 mph the stopping distance = 12 m (**ecf**) (1) 12 m is less than 15 m **or** 12 m is less than the distance after the bend **or** there is a 3 m gap so less chance of a collision (1)			3	3		
				Question 9 total	**1**	**7**	**5**	**13**	**8**	**0**

© WJEC CBAC Ltd.

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
10	(a)			Half-life is <u>too</u> short / <u>only</u> 13 hours (1) Don't accept very short or shorter So will decay [too] quickly [to treat cancer] / will need replacing frequently / doesn't last long enough [to treat the cancer] (1)		2		2		
	(b)			Half-life is longer / decays more slowly (1) [Combination of beta and] gamma will be more penetrating (1)		2		2		
	(c)			80 days = 10 half-lives (1) Series of halving starting from 1 or 100 % or 1 000 e.g. $1 \rightarrow \frac{1}{2} \rightarrow \frac{1}{4} \rightarrow \frac{1}{8}$ etc (1) Answer = $\frac{1}{1024}$ so 80 days is long enough **or** it will not trigger the monitors (1)			3	3	3	
				Question 10 total	**0**	**4**	**3**	**7**	**3**	**0**

© WJEC CBAC Ltd.

FOUNDATION TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	4	0	0	4	0	0
2	3	2	0	5	3	0
3	3	2	0	5	5	0
4	3	2	2	7	4	7
5	7	3	0	10	0	2
6	0	7	0	7	3	7
7	9	0	0	9	0	0
8	2	5	6	13	3	13
9	1	7	5	13	8	0
10	0	4	3	7	3	0
TOTAL	**32**	**32**	**16**	**80**	**29**	**29**

© WJEC CBAC Ltd.