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# **GCSE MARKING SCHEME**

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**SUMMER 2018**

**PHYSICS - COMPONENT 1  
FOUNDATION TIER  
C420U10-1**

## **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**  
**COMPONENT 1 – CONCEPTS IN PHYSICS**  
**FOUNDATION TIER**

**GENERAL INSTRUCTIONS**

Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (except for the extended response question).

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)	(i)		Cyan / peacock blue / turquoise				1			1																		
		(ii)		Magenta [accept purple]				1			1																		
	(b)			<table border="1"> <thead> <tr> <th>Spotlight colour</th> <th colspan="3">Tee-shirt colour</th> </tr> </thead> <tbody> <tr> <td>white</td> <td>red</td> <td>green</td> <td>blue</td> </tr> <tr> <td>blue</td> <td><b>BLACK (1)</b></td> <td>black</td> <td>blue</td> </tr> <tr> <td>yellow</td> <td>red</td> <td><b>GREEN (1)</b></td> <td>black</td> </tr> </tbody> </table>				Spotlight colour	Tee-shirt colour			white	red	green	blue	blue	<b>BLACK (1)</b>	black	blue	yellow	red	<b>GREEN (1)</b>	black	2			2		
Spotlight colour	Tee-shirt colour																												
white	red	green	blue																										
blue	<b>BLACK (1)</b>	black	blue																										
yellow	red	<b>GREEN (1)</b>	black																										
	(c)			X-rays (1) Microwaves (1)				2			2																		
				<b>Question 1 total</b>				<b>6</b>	<b>0</b>	<b>0</b>	<b>6</b>	<b>0</b>	<b>0</b>																

Question				Marking details				Marks available					
								AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		Electrons				1			1		
		(ii)		Attract (1) Repel (1)				2			2		
	(b)			Paint droplets spread / repel / even spray (1) Paint droplets attracted to car body / less waste / less dripping(1)					2		2		
				<b>Question 2 total</b>				<b>3</b>	<b>2</b>	<b>0</b>	<b>5</b>	<b>0</b>	<b>0</b>

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)		${}^4_2\text{He} / {}^4_2\alpha$ (ignore $\gamma$ )		1		1		
		(i)		${}^0_{-1}\text{e} / {}^0_{-1}\beta$ (ignore $\gamma$ )		1		1		
	(b)			92, 92, 146		3		3		
				<b>Question 3 total</b>	<b>0</b>	<b>5</b>	<b>0</b>	<b>5</b>	<b>0</b>	<b>0</b>

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)			2 concentric circles on either side (1) Anticlockwise arrows around left side (1) Clockwise arrows around right side (1)	1	1 1		3		3
	(b)	(i)		Becomes weaker [ignore reference to current]	1			1		1
		(ii)		Reverses [accept changes] direction	1			1		1
		(iii)		Becomes stronger	1			1		1
		(iv)		Becomes stronger	1			1		1
				<b>Question 4 total</b>	<b>5</b>	<b>2</b>	<b>0</b>	<b>7</b>	<b>0</b>	<b>7</b>

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)			Ticks in boxes 1, 3 and 4 Additional ticks: -1 per tick, minimum 0	3			3		
	(b)	(i)		Rocket exerts a downwards force on exhaust gases (1) which cause an upward force on the rocket (1)		2		2		
		(ii)		1 000 000 [N]		1		1		
		(iii)		Substitution: $\frac{1000\ 000\ \text{ecf}}{5\ 000\ 000}$ (1)	1	1		2	2	
		(iv)		<u>Resultant</u> force increases (1) Acceleration increases / mass decreases <u>and</u> $a=F/m$ (1) ...suggestion incorrect present for 2 marks			2	2		
				<b>Question 5 total</b>	<b>4</b>	<b>4</b>	<b>2</b>	<b>10</b>	<b>2</b>	<b>0</b>

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)		CD	1					
		(ii)		AE	1			2		
	(b)	(i)		6	1			1		1
		(ii)		$\frac{270}{6 \text{ ecf}} = 45$ [cm] (answer)		1		1	1	1
	(c)	(i)		Number of cycles / waves / wavelengths / oscillations / vibrations per second [or per <u>unit</u> time]	1			1		
		(ii)		$\frac{6 \text{ ecf}}{0.5}$ (1) [answer to (b)(i)/0.5] answer consistent with (b)(i): expect 12 Hz (1)		2		2	2	2
	(d)			Substitution: $45 \text{ (ecf)} \times 12 \text{ (ecf)}$ (1) $= 540$ [cm/s] (1)	1	1		2	2	2
	(e)			Wavelength is <u>double</u> (1) Frequency is <u>half</u> (1) Wave speed is the same so disagree (1)			3	3		3
				<b>Question 6 total</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>12</b>	<b>5</b>	<b>9</b>

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)	(i)		25 [m/s]	1			1	1	
		(ii)		Don't agree because it should be 30 [s] [Not just 'more than 10]			1	1		
	(b)	(i)		10 [s]	1			1		
		(ii)		15 [m/s]	1			1		
		(iii)		Recall and substitution: $\frac{15}{10}$ (1) = 1.5 [m/s <sup>2</sup> ] (1)	1	1		2	2	
		(iv)		Acceleration is less (1) because the <u>change</u> in velocity /speed in the same time is less / the graph is less steep or calculated acceleration of 1 m/s <sup>2</sup> (1)			2	2		
	(c)	(i)		Recall of $\text{speed} = \frac{\text{distance}}{\text{time}}$ or $x = \frac{1}{2}(u+v)t$ (1) Manipulation: distance = 5 × 10 (1) = 50 [m] (1) ACCEPT distance = area for first mark	1	1 1		3	2	
		(ii)		Distance travelled is greater (1) because travels at a greater constant speed <u>for the same time</u> (or 10 s) <b>or</b> calculation of distance 250 m ACCEPT area under that part of the graph is greater (1)			2	2		
				<b>Question 7 total</b>	<b>5</b>	<b>3</b>	<b>5</b>	<b>13</b>	<b>5</b>	<b>0</b>



Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)	(i)		8 [cm <sup>3</sup> ]		1		1		1
		(ii)		Substitution: $\frac{7.2}{8 \text{ ecf}}$ (1) = 0.9 [g/cm <sup>3</sup> ] (1)	1	1		2	2	2
		(iii)		Mass stays the same (1) Volume of water is less (since density is greater) (1)		2		2		2
	(b)	(i)		It is reversible (1) if energy is removed <b>or</b> so recovers original properties <b>or</b> because atoms do not combine <b>or</b> because no new compounds [or different ions] formed / (1)	2			2		
		(ii)		Vibrate more / KE increases [not just energy] (1) Breaking of bonds (1) Vibrate more / Move around faster / KE increases (1)	3			3		3
		(iii)		Selection of: $Q = mL$ (1) or by implication Substitution: $7.2 \times 334$ (1) = 2 404.8 OR 2 405 OR 2 400 [J] (1)	1 1	1		3	2	3
	(c)			Density decreases (1) as molecules get further apart (1)	2			2		2
				<b>Question 8 total</b>	<b>10</b>	<b>5</b>	<b>0</b>	<b>15</b>	<b>4</b>	<b>13</b>

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9	(a)	(i)		$V = V_1 + V_2 + V_3$	1			1		1
		(ii)		0.2 [A]	1			1		1
		(iii)		manipulation i.e. $\frac{12}{0.2}$ or $\frac{12}{\text{answer to (a)(ii)}}$ (1) = 60 $\Omega$ (1) c.a.o.		2		2	2	2
		(iv)		20 + 15 [= 35] (1) 60 <b>ecf</b> – 35 = 25 $\Omega$ (1)		2		2	1	2
	(b)			[Resistance decreases so] Current increases [when $R_3$ removed] (1) so voltage across other resistors increases (1) OR Now $V = V_1 + V_2$ (1) so $V_1 / V_2$ increase so agree (1) ...must say agree with statement for 2 marks			2	2		2
	(c)	(i)		$I_{\text{tot}} = I_1 + I_2 + I_3$	1			1		1
		(ii)		Decreases (1) Stays the same (1)	1	1		2		2
				<b>Question 9 total</b>	<b>4</b>	<b>5</b>	<b>2</b>	<b>11</b>	<b>3</b>	<b>11</b>

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
10	(a)		Output power transfer = 900 [W] (1) Use of: Efficiency = $\frac{\text{output power transfer}}{\text{input power transfer}}$ (1) [or by implication] $= 0.6$ (1) (Accept $\frac{6}{10}$ or 60%)	1	1		3	2	
	(b)	(i)	Electrical energy generated = $1\,000 \times 9\,000 = 9.0$ million J (1) No of g of CO <sub>2</sub> saved = $9.0 \times 120 = 1\,080$ which agrees with the claim (1) <b>ALTERNATIVE</b> $\frac{1000}{120} = 8.33$ million J (1) With either: 1 000 W could be generated for 8 333 s Or: 1 153 W could be generated for 9 000 s – to save 1 kg of CO <sub>2</sub> emissions so this agrees with the claim (1)			2	2	2	
		(ii)	CO <sub>2</sub> contributes towards global warming / climate change Or: To slow down global warming / climate change	1			1		

Question		Marking details		Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
	(c)		<p><b>Indicative content:</b></p> <p><b>Economic arguments</b></p> <ol style="list-style-type: none"> <li>1. Nuclear power stations last 3 times longer than wind turbines and provide 1 000 times bigger output power..so ..</li> <li>2. in the lifetime of one nuclear power station, 3 000 wind turbines need to be built costing £9G which is much more than 1 nuclear power station.</li> <li>3. The decommissioning costs of nuclear power station not in table – must be considered.</li> </ol> <p><b>Environmental arguments</b></p> <ol style="list-style-type: none"> <li>4. The wind turbines also cover a much larger land area (700 or 2 100 km<sup>2</sup>) so would have more impact on habitats.</li> <li>5. Radioactive waste is expensive to dispose of safely and remains a risk to life as it decays.</li> <li>6. Even though both types of power generation do not use fossil fuels but still have a carbon footprint during construction. This is slightly higher for nuclear power plants so they add more to the greenhouse effect.</li> </ol> <p><b>Sustainability arguments</b></p> <ol style="list-style-type: none"> <li>7. Output power for nuclear generation can be guaranteed 24/7/365 whereas wind power is unreliable.</li> <li>8. Wind will never run out and progress is being made in storage technology</li> </ol> <p><b>5 - 6 marks</b></p> <p>Expect to see at least 6 comments from across all three areas  <i>There is a sustained line of reasoning which is coherent, substantiated and logically structured. The information included in the response is relevant to the argument.</i></p>			6	6	3	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				<p><b>3 - 4 marks</b> Expect to see at least 3 comments from across at least two areas The candidate uses the data to make correct comparisons but does not fully appreciate the consequences of the ratios in power and/or lifetime. <i>There is a line of reasoning which is partially coherent, supported by some evidence and with some structure. Mainly relevant information is included in the response but there may be some minor errors or the inclusion of some information not relevant to the argument.</i></p> <p><b>1-2 marks</b> Expect 1 or 2 comments from any areas. <i>There is a basic line of reasoning which is not coherent, supported by limited evidence and with very little structure. There may be significant errors or the inclusion of information not relevant to the argument.</i></p> <p><b>0 marks</b> <i>No attempt made or no response worthy of credit.</i></p>						
				<b>Question 10 total</b>	<b>2</b>	<b>2</b>	<b>8</b>	<b>12</b>	<b>7</b>	<b>0</b>

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
11	(a)			1.2 in second column (1) 7.4 in third column (1)		2		2	1	2
	(b)	(i)		Suitable scales using at least half of the graph in each direction and avoiding multiples of 3 (1) All six points plotted to within $\pm\frac{1}{2}$ small square (2) Five points plotted to within $\pm\frac{1}{2}$ small square (1) Four or fewer points plotted to within $\pm\frac{1}{2}$ small square (0) Best fit straight line through the origin drawn with a ruler (1)		4		4	4	4
		(ii)		Reading to be taken from candidate's graph – expect $1.10 \pm$ half square tolerance (i.e. 0.01) [N]		1		1		1
		(iii)		Recall and substitution: e.g. $k = \frac{F}{x} = \frac{1.1 \text{ (e.c.f.)}}{4.4}$ (1) Conversion of 4.4 to 0.044 (1) $k = 25$ [N/m] (1) [accept $k = 0.25$ for 2 marks] Values should be taken from the graph not the table. Apply values from the graph. Do not accept extensions of 2.5 or 3.1 which do not lie on the line of best fit. Conversion mark is still available.	1	1 1		3	3	3
		(iv)		Straight line from origin above the original line (1) Exactly double the gradient of the original line (1)		2		2	1	2
				<b>Question 11 total</b>	<b>1</b>	<b>11</b>	<b>0</b>	<b>12</b>	<b>9</b>	<b>12</b>

Question				Marking details	Marks available						
					AO1	AO2	AO3	Total	Maths	Prac	
12	(a)	(i)		Recall moment = $F \times d$ (1) [or by implication] Substitution: $650 \times 18$ [ $\times 10^{-2}$ ] (1) = 11 700 N cm = 117 [Nm] (1) Allow 1 mark for correct conversion $\rightarrow$ 0.18 m if no other calculation mark given.	1 1				3	2	
		(ii)		1 300 [N]		1			1	1	
	(b)	(i)		The range of ratios available on the second gear are all available on either first or third gear on the chain-ring			1		1		
		(ii)	I	Recall $f = \frac{1}{T}$ (1) [or by implication] $= \frac{1}{0.8} = 1.25$ [Hz] (1)	1				2	1	
			II	Gear ratio = 1.58:1 or 38:24 [or equiv or by implication] (1) No of rotations per second = 1.25 ecf $\times$ 1.58 <b>ecf</b> (1) = 1.975 <b>ecf</b> (1)				3	3	3	
			III	Circumference = 2.36 m (1) for conversion Speed = $2.356 \times 1.975$ ecf = 4.66 [m/s] (1)		2			2	2	
				<b>Question 12 total</b>	<b>3</b>	<b>5</b>	<b>4</b>		<b>12</b>	<b>9</b>	<b>0</b>

## COMPONENT 1 - Concepts in Physics

### FOUNDATION TIER

#### SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	6	0	0	6	0	0
2	3	2	0	5	0	0
3	0	5	0	5	0	0
4	5	2	0	7	0	7
5	4	4	2	10	2	0
6	5	4	3	12	5	9
7	5	3	5	13	5	0
8	10	5	0	15	4	13
9	4	5	2	11	3	11
10	2	2	8	12	7	0
11	1	11	0	12	9	12
12	3	5	4	12	9	0
<b>TOTAL</b>	<b>48</b>	<b>48</b>	<b>24</b>	<b>120</b>	<b>46</b>	<b>52</b>