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# GCSE MARKING SCHEME

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**SUMMER 2018**

**SCIENCE (DOUBLE AWARD)  
PHYSICS - UNIT 3  
HIGHER TIER  
3430UC0-1**

## **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 - UNIT 3**  
**SUMMER 2018 MARK SCHEME**  
**UNIT 3: (Double Award) PHYSICS 1 (HIGHER TIER)**  
**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)		The {vibrations / oscillations} (1) are {at right angles at 90° / perpendicular} to the <u>direction</u> of {energy transfer / wave travel / propagation / motion} (1)	2			2		
	(b)	(i)	1.2[2] in middle column (2 or 3 sig figs) (1) 5.85 in final column (3 sig figs) (1) accept 5.86		2		2	2	
		(ii)	When depth changes from 1.0 to 4.0 (quadrupled) (1), the speed doubles, e.g. 3.13 to 6.26 (pair of values quoted) (1)  Accept other pair of values, e.g. 0.5 m → 2 m (1) and calculated speed for 2.0 m (4.426) using equation compared with speed for 0.5 m (2.21) (1)  To award 2 marks 'statement is true' [or equiv] must be made  NB purely mathematic argument based upon $\sqrt{4} = 2 \rightarrow 0$ marks			2	2	2	
		(iii)	Depth of water scale chosen to accommodate more than half the graph (1) (Best scales are 0.5 m per square and 1 m/s per square)  All 6 <u>given</u> points plotted within tolerance of <1 small square [ignore origin] (2) 5 <u>given</u> points correctly plotted within tolerance of <1 small square (1)  Smooth curve drawn through the points from $d = 1$ m to $d = 4$ m within <1 small square tolerance from each square with attempt to draw curve to origin (1)  NB. Use of given data values to label major lines on speed axis → 0 marks Missing 2 m on the depth axis → lose the scales mark only and curve needs to be best fit.  If vertical scale is for $\sqrt{d} \rightarrow 0$ marks	1					
					2				
					1		4	4	

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)	Use of value taken from graph within $< 0.1$ at 2.0 m [expect 4.4 m/s] (1) Substitution: wavelength = $\frac{4.4}{0.2}$ (1) =22.0 m (1) Use of $v = 3.13\sqrt{d}$ to give 4.43 m/s $\rightarrow$ lose first mark	1	1  1		3	3	
		(ii)	If frequency is constant (1) as speed increases wavelength increases (1)  Alternative [by calculation] Using 0.2 Hz (1) and calculating wavelength at a different stated depth (1)  To award 2 marks 'suggestion not true' [or equiv] must be made			2	2		
			<b>Question 1 total</b>	<b>4</b>	<b>7</b>	<b>4</b>	<b>15</b>	<b>11</b>	<b>0</b>

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
2	(a)		<p><b>Any two × (1) from the following:</b></p> <ul style="list-style-type: none"> <li>• Cables can be thinner [because there are two paths for the current]</li> <li>• Each part of the cable carries less current [because the current flows two ways]</li> <li>• Sockets can be {placed / added} anywhere on the ring</li> <li>• Same voltage [accept 230 V or 240 V] for all sockets <b>or</b> separate switching</li> </ul>	2			2		
	(b)	(i)	To carry the {current / power / energy} {to the appliance / to the socket / at high voltage} NB not: 'electricity'	1			1		
		(ii)	Carries current [safely] to ground <b>or</b> prevents {[electric] shock / electrocution} (1) if the metal of an appliance frame becomes <u>live</u> [or <u>live</u> wire touches the metal case of an appliance] (1)	2			2		
	(c)	(i)	a.c. is a current that [continuously] changes <u>direction</u> (1) a.c. is a current that [continuously] changes in <u>magnitude</u> [or size](1) (Accept converse answers about d.c.)	2			2		





Question		Marking details	Marks available					
			AO1	AO2	AO3	Total	Maths	Prac
3	(i)	Substitution: $V=IR = 2 \times 2$ (1) $= 4$ [V] (1)  NB $12 \text{ V} \div 3 = 4 \text{ V} \rightarrow 0$ marks unless justified, e.g. by a potential divider argument.	1	1		2	2	2
	(ii)	Either: voltage across parallel pair = $12 - 4$ <b>ecf</b> = 8 [V] (1) NB. If 6 V is used [possible ecf from (i)], $12 - 6 = 6$ must be shown to get any credit  Substitution: current through $R_2 = \frac{V}{R_2} = \frac{8 \text{ ecf}}{12}$ (1) $= 0.67$ [A] (1) Current through $R_3 = 2 - 0.67$ <b>ecf</b> = 1.33 [A] (1) {or $\frac{V}{R_3} = \frac{8 \text{ ecf}}{6} = 1.33$ [A] for final mark} (1)  <b>OR to get the first mark:</b>  For first mark: Resistance of parallel pair = 4 $\Omega$ (e.g. using $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$ )  <u>and</u> $V_{\text{parallel}} = IR_{\text{parallel}} = 2 \times 4 = 8$ [V] (1)  <i>OR complete answer as follows:</i> Statement: currents add to 2 A (1) Statement current in the ratio 2:1 or 1:2 (1) Substitution: Currents in two arms of parallel circuit = 0.67 A and 1.33 A (1) Correct allocation: Current in 12 $\Omega$ = 0.67 A; Current in 6 $\Omega$ = 1.33 A (1) NB. Current not adding to 2 A in ratio 2:1 $\rightarrow 0$ marks.  NB. $I_2 = 0.33$ A and $I_3 = 0.67$ A $\rightarrow 0$ marks [arises from use of 4 V]	1	1  1 1		4	4	4
<b>Question 3 total</b>			<b>2</b>	<b>4</b>	<b>0</b>	<b>6</b>	<b>6</b>	<b>6</b>

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)	{Its/gas} {cost/bill} [accept: its cost] decreased [after solar panels installed] [accept: less gas used]. Not: electricity didn't go down / decreased [neutral]			1	1		
		(ii)	Gas cost dropped by £950 - £840 [= £110] (1) payback period = $\frac{4\,680}{110} = 42.5$ [y] (1) [Accept 43; not 42] <b>Accept</b> Total cost dropped by £60 (1) payback period = $\frac{4\,680}{60} = 78$ (1)		1 1		2	2	
		(iii)	Payback time reduced (1).... ...[because ] money saved would increase (1) The unit cost of electricity would make no difference to the payback time (1)						
	(b)		Saving = £50 (1) Division of a sum of money by 300 shown (1) Answer 16.7 [p] (1) [accept 17 p, not 16.6 p]  NB. Answer = 0.16[7] [p] → 2 marks	1	2		3	3	
			<b>Question 4 total</b>	<b>1</b>	<b>7</b>	<b>1</b>	<b>9</b>	<b>5</b>	<b>0</b>

Question		Marking details		Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
5	(a)		<p>As the water is heated {it expands / its volume increases} and density decreases (1) The cooling water's volume decreases and its density increases (1)</p> <p><b>Or</b> density decreases when [water] heated <b>and</b> density increases when it cools(1).. .. because {it / water} expands when heated <b>and</b> contracts when cools (1)</p> <p>Not: <u>particles</u> expand or become less dense</p>	2			2		2
	(b)		<p><b>Indicative content:</b> <b>Ion/lattice process</b></p> <ol style="list-style-type: none"> <li>the molecules/ions at the “high temperature end” of the substance gain energy</li> <li>and vibrate with increasing amplitude / kinetic energy.</li> <li>They transfer their energy to other neighbouring molecules/ions by collisions and this continues through the body of the material.</li> </ol> <p><b>Free-electron process</b></p> <ol style="list-style-type: none"> <li>Copper has free (or de-localised or mobile) electrons which gain energy at the “high temperature end”</li> <li>and move / migrate towards the “lower temperature end”,</li> <li>transferring energy more quickly</li> </ol> <p><b>5 – 6 marks</b> Expect at least 4 statements with at least two from each process A correct, description of the two processes that identify metals as good conductors of thermal energy is given. <i>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.</i></p>	6			6		6

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				<p><b>3 – 4 marks</b> Expect at least 1 statement from each process A reasonable attempt is made at describing both processes OR a totally correct, detailed description of one of the processes is given. The candidate typically uses terms like "vibrates more". <i>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.</i></p> <p><b>1-2 marks</b> Expect any statement from either of the processes An attempt is made at explaining conduction in terms of particle movement without the identity of the particles being stated – usually of the vibration of molecules in which the candidate typically uses the term "the molecules start to vibrate..." <i>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.</i></p> <p><b>0 marks</b> <i>No attempt made or no response worthy of credit.</i></p>						
				<b>Question 5 total</b>	<b>8</b>	<b>0</b>	<b>0</b>	<b>8</b>	<b>0</b>	<b>8</b>

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)	General downward trend in the use of fossil fuels over the period (1) Any 2 × (1) for <ul style="list-style-type: none"> <li>• [Significant] decrease in [use of] coal (✓)</li> <li>• increase in [use of] gas (✓)</li> <li>• stable [use of] oil (✓)</li> </ul> NB Any discussion of nuclear → 2max			3	3		
		(ii)	Any 2 × (1) for Nuclear power stations run all the time (✓) No new nuclear stations have come on line in that time [or converse](✓) nuclear power stations do not contribute to CO <sub>2</sub> emissions (✓)		2		2		
		(iii)	less windy [in 2016] (1) [accept: too windy to operate] sunnier [in 2016] (1)			2	2		
	(b)	(i)	3 900 and 2 544 used (1) [or by implication] answer = 35% (1)  NB. Answer of 65% → 1 mark (the first one)		2		2	2	
		(ii)	Good progress is being made {in the electricity generation sector / because 40%[in 2022] leads to 50% [by 2027] or wtte} (1) However there are other sources of emission [which haven't been taken into consideration]. (Accept named sources e.g. emissions from domestic heating / vehicle emissions etc. in the answer) (1)			2	2		
			<b>Question 6 total</b>	<b>0</b>	<b>4</b>	<b>7</b>	<b>11</b>	<b>2</b>	<b>0</b>

## HIGHER TIER

### SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	Marks Available					
	AO1	AO2	AO3	Total	Maths	Prac
<b>1</b>	<b>4</b>	<b>7</b>	<b>4</b>	<b>15</b>	<b>11</b>	<b>0</b>
<b>2</b>	<b>9</b>	<b>2</b>	<b>0</b>	<b>11</b>	<b>4</b>	<b>0</b>
<b>3</b>	<b>2</b>	<b>4</b>	<b>0</b>	<b>6</b>	<b>6</b>	<b>6</b>
<b>4</b>	<b>1</b>	<b>7</b>	<b>1</b>	<b>9</b>	<b>5</b>	<b>0</b>
<b>5</b>	<b>8</b>	<b>0</b>	<b>0</b>	<b>8</b>	<b>0</b>	<b>8</b>
<b>6</b>	<b>0</b>	<b>4</b>	<b>7</b>	<b>11</b>	<b>2</b>	<b>0</b>
<b>Total</b>	<b>24</b>	<b>24</b>	<b>12</b>	<b>60</b>	<b>28</b>	<b>14</b>