GCSE MARKING SCHEME

SUMMER 2018

SCIENCE (DOUBLE AWARD)
PHYSICS - UNIT 3
FOUNDATION TIER
3430U30-1

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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.

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GCSE PHYSICS - UNIT 3

SUMMER 2018 MARK SCHEME

UNIT 3: (Double Award) PHYSICS 1 (FOUNDATION 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.

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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)		Increasing frequency No alternatives acceptable		1		1		
		(ii)		Infra-red / i.r. Not: red/ thermal / heat	1			1		
	(b)	(i)		Gamma / γ	1			1		
		(ii)		Interact with our atoms/ {damage / harm / kills} cells/ [cause] cancer/ mutate {cells / DNA} Accept: ionise cells.	1			1		
				Question 1 total	**3**	**1**	**0**	**4**	**0**	**0**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	*(a)*	(i)		8 [Ω] cao	1			1		1
		(ii)		Substitution into $I = \frac{V}{R}$ i.e. $\frac{12}{8}$ **ecf** (1) = 1.5 [A] (1)	1	1		2	2	2
		(iii)		= answer to *(a)* (ii) (1) NB. 1.5 [A] (1) If (a)(ii) not answered, [Not just '= A_1 reading']	1			1		1
	(b)	(i) (ii)		decreases (1) increases (1) no ecf	1	1		2		2
				Question 2 total	**4**	**2**	**0**	**6**	**2**	**6**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	*(a)*			**Indicative content**: 1. Heat energy from the room will transfer from high temperature to low temperature. 2. The bigger the temperature (gradient) difference the greater the rate of heat flow will be greater. 3. The cavity board is made from foam which is itself a good insulator/bad conductor, which reduces heat loss by conduction. 4. Trapped air in the foam & between the board and the walls also reduces convection currents in the cavity and reduces heat loss by convection. 5. The foam has an inner shiny silver surface that faces into the house and is a poor absorber. Radiation from the house will be reflected back into the house. 6. The outer shiny surface is a poor emitter of i-r radiation. 7. Consequently the temperature of the outer wall / surrounding air is less, reducing convection losses from the outside wall. **5 – 6 marks** Expect at least 4 statements. *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** Expect at least 2 statements Alternatively, a brief description of all three heat loss reduction processes. *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		

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				1-2 marks Any correct statement. *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.*						
	(b)	(i)		Use of £385 and £110 (1) [or by implication] Payback time = 3.5 years so disagree [or equiv. e.g. 'no'] (1) **Alternative**: 110 + 110 + 110 [or 3 × 110] = 330 (1) < 385 so disagree. (1)		1	1	2	1	
		(ii)		Answers in the table: CO_2 saving = 640 (1) Carbon footprint = 2 000 (1)		2		2	2	
		(iii)		Mid-terraced house (1) cao lowest {carbon footprint / emission of CO_2} (1) NB reference to 'saving' → 1st mark only NB 2nd mark can only be awarded if first mark is given. Do not accept just values from the table unless all three values compared.			2	2		
				Question 3 total	**3**	**6**	**3**	**12**	**3**	**0**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	*(a)*	(i)		59.4 [g]	1			1		1
		(ii)		3 / 3.0 [cm]	1			1		1
		(iii)		Answer to (ii) cubed – expect 27 [cm^3] **ecf**		1		1	1	1
		(iv)		Substitution: $\frac{59.4}{27\ \textbf{ecf}}$ (1) [or ecf on mass from (i)] = 2.2 (1) [Accept 2 but not 2.0] g/cm^3 (1)	1 1	1		3	2	3
	(b)	(i)		Any 2 × (1) • check repeatability [accept: check the results] or increase confidence [in the results](1) • to calculate a mean [accept: average] [value] (1) • <u>identify</u> anomalous results (1) Do not accept: more accurate or reliable			2	2		2
		(ii)		Better resolution instruments e.g. ruler with mm scale / more d.p. [accept: use mm / mg] Do not accept accurate or precision.			1	1		1
	(c)			Ticks in the 3rd and 4th boxes (1) + (1) **Note -** For each extra tick subtract 1 mark. No negative mark.		2		2	1	2
				Question 4 total	**4**	**4**	**3**	**11**	**4**	**11**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	*(a)*			continuously changes direction (1)	1			1		
	(b)	(i)		Substitution into $E = Pt$: 2 600 × 15 (1) = 39 000 [J] Total energy = 39 000 ecf × 6 (1) = 234 000 [J] (1) cao **Alternative** 15 × 6 (1) = 90 [s] $E = P\ t$ = 2 600 × 90 ecf (1) = 234 000 [J] (1) cao NB × 15 (1) × 6 (1) Answer 234 000 (1) 15 × 6 = 90 → 1 mark only Use of 230 V in calculation → 0 marks.	1	1 1		3	3	
		(ii)		Substitution: $\frac{2\,600}{230}$ (1) =11.3 [A] (1) [accept 11 A]	1	1		2	2	
		(iii)		same answer as (ii): expect live =11.3 **and** neutral = 11.3 (1) earth = 0 (1)	1	1		2		
	(c)			[Detects] {current / magnetic field} difference (1) ... . between the live and neutral [leads] (1)	2			2		
	(d)			½ power (1) same {number of kWh / number of units / energy} (1) Or by calculation 1300 W × 30 s (1) = 39 000 J + comparison with 2 600 × 15 [or 39 000](1) To award 2 marks 'claim is not true' [or equiv] must be seen.			2	2	1	
				Question 5 total	**6**	**4**	**2**	**12**	**6**	**0**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(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 from 3.13 to 6.26 (pair of values quoted) (1) Accept other pairs of values, e.g. 0.5 m $\rightarrow$ 2.0 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 and speed scales 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 with attempt to draw curve to origin (1) NB. Use of given data values to label major lines on speed axis $\rightarrow$ 0 marks Missing 2 m on the depth axis $\rightarrow$ 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	

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	(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 depth (1) To award 2 marks 'suggestion not true' [or equiv] must be made			2	2		
				Question 6 total	**4**	**7**	**4**	**15**	**11**	**0**

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SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	Marks Available					
	AO1	AO2	AO3	Total	Maths	Prac
1	3	1	0	4	0	0
2	4	2	0	6	2	6
3	3	6	3	12	3	0
4	4	4	3	11	4	11
5	6	4	2	12	6	0
6	4	7	4	15	11	0
Total	24	24	12	60	26	17

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