



GCSE MARKING SCHEME

SUMMER 2018

**GCSE (NEW)
PHYSICS - UNIT 1 (HIGHER TIER)
3420UA0-1**

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
UNIT 1: ELECTRICITY, ENERGY AND WAVES

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)	(i)	Same distance between lamp and LDR (1) Same {ambient / background / room } lighting (1)	2			2		2
		(ii)	Enclose lamp and LDR in a container e.g. tube / carry out experiment in a darkened room (1) So no ambient light affects LDR (1)			2	2		2
	(b)	(i)	Scales: y-axis: 2 k Ω per 2 cm (1) The 6 points between $P = 4$ and 24 W plotted correctly to within $\pm <$ small square division (2) 5 correct plots (1) Smooth curve of best fit between $P = 4$ and 24 W with $\pm <$ small square division tolerance; may miss one point (1) [No hairy lines] Non-linear scale \rightarrow total mark 0.	1	2 1		4	4	4
		(ii)	Read from graph 2600 Ω / 2.6 k[Ω]		1		1	1	1
		(iii)	From 12 [W] to 24 [W] the resistance goes from 2.2 [k Ω] to 1.1 [k Ω], or 8 to 16, from 3 to 1.5 (1) Other doubling e.g. 2 [W] to 4 [W] resistance goes from 19.5 [k Ω] to 10.3 [k Ω] or 4 to 8, from 10.3 to 3 (1) Therefore sometimes true, sometimes not or w.t.t.e (1) NB 3rd mark only given following arguments for first and second mark presented (whether marks awarded or not)			3	3	1	3

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			Substitution: $0.35 = \frac{2.8}{R}$ (1) Manipulation: $R = \frac{2.8}{0.35}$ (1) Resistance = 8 000 [Ω] or 8 k[Ω] (1) $R = 8 \times 10^n$ ($n \neq 3$) \rightarrow 2 marks $2.8 \times 0.35 = 0.98 \rightarrow$ 0 marks [unless first mark awarded]	1	1 1		3	3	
				Question 1 total	4	6	5	15	9	12

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)			Ticks in boxes 3, 4 and 5 i.e $3 \times (1)$ Extra box ticked -1	3			3		
	(b)	(i)	I	8 min 20 s		1		1	1	
			II	6 min 40 s		1		1	1	
		(ii)		Arrival time of P waves: 00 : 16 : 00 (1) Time difference: 00 : 02 : 40 ecf (1) [unless P wave arrival time > 18:40:00] Distance to epicentre: 1.6 ± 0.2 [$\times 10^3$ km] ecf from Δt (1) [no ecf on $d > 10 \times 10^3$ km] 1:40 $\rightarrow d = 1$ 2:00 $\rightarrow d = 1.2$ $d = 1.4, 1.6, 1.8$ in tolerance 3:20 $\rightarrow d = 2$			3	3	3	
		(iii)		1 correct circle or arc \rightarrow 1 mark 2 correct circles or arcs \rightarrow 2 marks 2 correct circles or arcs + labelled X \rightarrow 3 marks (even if BC is incorrect) 3 circles or arcs intersecting at (almost) a point \rightarrow 3 marks (even without X)			3	3	2	
				Question 2 total	3	2	6	11	7	0

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)			Volume of solid = 8 cm^3 (1) Substitution: $\frac{26}{8}$ (1) [Allow substitution mark with 40 or 48 cm^3] = $3.25 \text{ [g/cm}^3\text{]}(1)$ Use of 40 cm^3 ($\rightarrow 0.65 \text{ g/cm}^3$) or 48 cm^3 ($\rightarrow 0.54 \text{ g/cm}^3$) : 1 mark NB. Allow ecf on incorrect volume of solid only if calculation of volume shown, e.g. $48 - 40 = 4$ leading to $6.5 \text{ [g / cm}^3\text{]}$	1	1 1		3	3	3
	(b)			Method of submerging object [e.g. sinker or pencil point] (1) Determination of <u>total</u> volume displaced by object and submerging object (1) Accounting for the volume of the submerging object [e.g. subtracting volume of sinker / <u>just</u> submerging by pencil point](1) Use of liquid of lower density in which the object sinks \rightarrow first mark only.			3	3		3
	(c)			Particles in solids are <u>more</u> closely packed [or most solid {molecules / particles} are heavier than water molecules] (1) so more {contained / mass} per unit volume (1)	2			2		
				Question 3 total	3	2	3	8	3	6

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)			<p>Any 3 (×1) from:</p> <ul style="list-style-type: none"> the cables can be made thinner [because there are two paths for the current] Each part of the cable carries less current [because the current flows two ways] sockets can be {placed / added} anywhere on the ring each socket has 230V [accept: same voltage] applied or they can be operated separately 	3			3		
	(b)	(i)		MCB / fuse (1) [not just: circuit breaker] <u>current</u> overload / too much <u>current</u> / <u>current</u> surge (1)		2		2		
		(ii)		RCCB / RCD / ELCB (1) [not: Earth wire or just circuit breaker] {current / magnetic field} difference <u>between L and N</u> (1)		2		2		
	(c)			If a fault develops where live wire touches casing (1) Metal is a conductor and plastic is an insulator (1) Not: reference to 'heat conductor' or equiv.	2			2		
				Question 4 total	5	4	0	9	0	0

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)	<p>At least 2 satellites indicated which could be used for communicating between A and B, e.g. at 2 o'clock and 4 o'clock (1)</p> <p>Additional ground station indicated which can communicate with the satellites (1)</p> <p>Lines up and down A → satellite → ground station → satellite → B (1)</p> <p>If more than 2 satellites drawn, the system must be capable of working to award any and each mark.</p>		3		3		
		(ii)	<p>[A base station can be in constant communication with a geostationary satellite] because it always stays in the same position above the Earth (1)</p> <p>but only once every 24 h with a geosynchronous satellite (1)</p>	2			2		
	(b)		<p>Doubling of distance = $2 \times 3.6 \times 10^4$ [= 7.2×10^4 km] (1)</p> <p>Substitution: 3×10^8 [m/s] = $\frac{7.2 \times 10^4 [\text{km}]}{\text{time}}$ (1) ecf on not doubling distance.</p> <p>Manipulation and conversion: $\text{time} = \frac{7.2 \times 10^7}{3 \times 10^8}$ (1)</p> <p>Time = 0.24 [s] [1]</p> <p>Answer of 0.12 s (3)</p> <p>NB 24×10^n ($n \neq -2$) → 3 marks</p> <p>12×10^n ($n \neq -2$) → 2 marks</p>	1	1		4	4	
			Question 5 total	3	6	0	9	4	0

Question		Marking details	Marks Available					
			AO1	AO2	AO3	Total	Maths	Prac
6	(a)	<p>Indicative content:</p> <p>Changing temperature</p> <ol style="list-style-type: none"> 1. Along AB the temperature of the ice increases and the vibrational /kinetic energy of the molecules increases. 2. Along CD the temperature of water increases and the KE of molecules increases. 3. Along EF the steam temperature increases and KE of molecules increases. <p>Changing state from solid to liquid</p> <ol style="list-style-type: none"> 4. Along BC the energy supplied breaks bonds between molecules 5.which allows them to move past one another. <p>Changing state from liquid to gas</p> <ol style="list-style-type: none"> 6. Along DE the energy supplied breaks bonds between molecules 7.which allows them to escape from one another. 8. More bonds broken when boiling so DE longer than BC. <p>5 – 6 marks A detailed description including all three sections <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> <p>3 – 4 marks A partial description which may be from 2 or 3 sections. <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>	6			6		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
				<p>1-2 marks Any relevant comment on any aspect of the graph <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>0 marks <i>No attempt made or no response worthy of credit.</i></p>						
	(b)	(i)		<p>It takes 336 000 [J] to melt 1 kg of ice (1) ...into water at the same temperature / at its melting point (1)</p>	2			2		
		(ii)		<p>Conversion 800 g to 0.8 kg (1) Substitution with correct temperature change into $\Delta Q = mc\Delta\theta$ i.e. $0.8 \times 2030 \times 23$ (1) = 37 352 [J] (1) Substitution and answer into $Q = mL$ i.e. $0.8 \times 336\,000$ = 268 800 [J] (1) Total energy = 306 152 ecf [J] (1) → 5 marks</p> <p>306 152 000 J → 4 marks 37 352 J → 3 marks 37 352 000 J → 2 marks 268 800 J → 2 marks 268 800 000 J → 1 mark</p>		5		5	5	
				Question 6 total	8	5	0	13	5	0

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
7	(a)		<p>Between 6:00 and 10:00 the wind speed is [just] above 3.5 m/s [or cut-in speed](1) so the power output will be low (1) After 16:00, power not produced until 19:00 (1) by 20:00 speed rises to about 4.2 m/s which still gives low power output (1) NB numerical information needed for marks 1, 3 and 4. Only award 4 marks if 'claim not supported' stated</p>		1 1	1 1	4		
	(b)	(i)	<p>Substitution into transformer equation e.g. $\frac{V_2}{16} = \frac{4800}{400}$ (1) or $V_2 = \frac{4800}{400} \times 16$ $V_2 = 192$ [kV] (1) c.a.o.</p>		2		2	2	
		(ii)	<p>Manipulation: $I = \frac{P}{V}$ (1) Substitution: $I = \frac{24[\times 10^6]}{192[\times 10^3]} \text{ecf}$ (1) Current = 125 [A] (1) NB. $1.25 \times 10^n (n \neq 2) \rightarrow 2$ marks NB. $I = \frac{V}{R} = \frac{24[\times 10^6]}{192[\times 10^3]} = 125 \rightarrow 0$ marks</p>		3		3	3	

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)		Step up transformer increases voltage / reduces current (1) to reduce {power / energy} losses in cables [not: no energy loss] (1) Step down transformer reduces voltage to safe[r] values for consumers (1)	3			3		
		(ii)		[(An alternating] magnetic field from primary links with secondary coil (1) Iron core strengthens magnetic field (1) Laminations reduce heat losses in the core / improves efficiency or transfers energy efficiently [not: no energy loss] (1)	3			3		
				Question 7 total	6	7	2	15	5	0

HIGHER TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	4	6	5	15	9	12
2	3	2	6	11	7	0
3	3	2	3	8	3	6
4	5	4	0	9	0	0
5	3	6	0	9	4	0
6	8	5	0	13	5	0
7	6	7	2	15	5	0
TOTAL	32	32	16	80	33	18