GCSE MARKING SCHEME

SUMMER 2019

PHYSICS UNIT 1 FOUNDATION (SEPARATE AWARD)
3420U10-1

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.

GCSE PHYSICS

UNIT 1: ELECTRICITY, ENERGY AND WAVES

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.

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

<table>
<tr><th colspan="3" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td>Any 2 × (1):
- P waves are longitudinal or S waves are transverse
- Only P waves can pass through liquids / outer core or S waves only travel through solids or S waves can’t travel through liquids / outer core
- P waves are faster (or converse) / P waves arrive first
- S waves are more damaging</td><td>2</td><td></td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td><table><tr><th></th><th>P wave</th><th>S wave</th><th>Surface wave</th></tr><tr><td>A</td><td>✓</td><td>✓</td><td>✓</td></tr><tr><td>B</td><td>✓</td><td>✓</td><td>✓</td></tr><tr><td>C</td><td>✓</td><td></td><td>✓</td></tr></table>Award one mark for each correct column.</td><td>3</td><td></td><td></td><td>3</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>Question 1 total</td><td>5</td><td>0</td><td>0</td><td>5</td><td>0</td><td>0</td></tr>
</table>

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
2	*(a)*		**3 × (1):** Ticks in boxes alongside statements 1, 3, 6 i.e. -The direction of the magnetic field is from N to S in the diagram. -A current from **X** to **W** makes the wire move upwards. -This effect is used in electric motors. Deduct 1 mark for each additional tick	3			3		
	(b)		**Any 3 ×(1) from:** -Use stronger **or** weaker magnets -Magnets closer together **or** magnets further apart -Change current or battery voltage -Alter resistance of wire **or** thinner or thicker wire **or** change type of wire **-**Wider or narrower magnets **or** change length of wire <u>in the field</u> **or** make a coil **Treat as neutral:** remove magnet **or** turn battery off **or** bigger magnets **or** move the magnets			3	3		
	(c)		Arrow on YZ from Y to Z labelled C (1) Arrow on/near YZ up the page labelled F (1) N.B. If only one arrow is labelled correctly, both marks can be awarded If there are no labels then no marks can be awarded		2		2		
			Question 2 total	**3**	**2**	**3**	**8**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	*(a)*			**Indicative content:** **RELIABLE** The power stations are all joined by a network of cables so that if any one of them fails or is off-line for maintenance, or there is a sudden surge in demand, then others can make up for the deficit e.g. pumped storage systems can be used. Electrical power can also be imported from abroad for this purpose. **EFFICIENT** The efficiency of the grid is high because the electricity that is generated is increased to a very high voltage by a step-up transformer at the power station for transmission along the grid cables. This reduces current in the cables and minimises energy losses due to heating, improving efficiency. **SAFE** The high voltage is finally reduced in a step-down transformer before being supplied to factories, towns, schools and homes to make it safer to use. Pylons support cables high above the ground. **5-6 marks** Comprehensive description of all 3 areas i.e. reliability, efficiency and safety. *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** Comprehensive description of 2 out of 3 areas i.e. reliability, efficiency and safety **or** limited description of all 3 areas. *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		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				1-2 marks Comprehensive description of 1 out of 3 areas i.e. reliability, efficiency and safety **or** limited description of 1 or 2 areas. *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)		Sweden		1		1		
		(ii)		Norway uses more heating / lighting (1) because they get longer winters **or** colder **or** darker (1) **Don't accept** more people			2	2		
		(iii)		Units used in Norway = 4 times as much as in U.K. (1) Cost in Norway = 2 times its cost in the U.K. (1) so disagree To award both marks the conclusion must be present			2	2	2	
		(iv)	I.	$3 \times 5 \times 7$ (1) = 105 [kWh] (1) Answer of 15 **OR** 21 **OR** 35 seen anywhere award 1 mark	1	1		2	2	
			II.	Cost = 105 **ecf** $\times$ 8 (1) = 840 [p] (1) Award 1 mark only for 105 **ecf** $\times$ 0.08 = 8.40	1	1		2	2	
				Question 3 total	**8**	**3**	**4**	**15**	**6**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
4	*(a)*	(i)	Clockwise in order: Cell (or battery) (1) Voltmeter (1) Ammeter (1) **Don't accept** ampmeter or voltameter	3			3		3
		(ii)	To allow a series of readings to be taken **or** to change the current or the voltage **or** to change the resistance <u>of the circuit</u>	1			1		1
	(b)	(i)	5 points plotted correctly ±< one small square (2) ignore no plot plotted at origin 4 points plotted correctly ±< one small square (1) 3 or fewer points plotted correctly ±< one small square (0) Straight line drawn through the points **and origin** ±< one small square (1)		3		3		3
		(ii)	$R = \frac{V}{I} = \frac{8}{\text{correct reading from graph}}$ (1) Expected answer = 2.5 [Ω] (1)	1	1		2	2	2
		(iii)	Increases (1) Constant (1) Stays constant (1)		3		3		3
		(iv)	(Argument based on $P = V \times I$) so since both V and I increase through the experiment (1) the power = $V \times I$ increases (1) so agree **OR** By carrying out one calculation using $P = V \times I$ (1) Second calculation (1) so agree To award both marks the conclusion must be present			2	2	2	2
		(v)	Straight line drawn <u>from origin</u> ±< one small square with **bigger** gradient than original (1) Double the gradient (i.e. through point (6, 4.8)) (1)		2		2		2
			Question 4 total	**5**	**9**	**2**	**16**	**4**	**16**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
5	*(a)*		Lines up to satellite **and** down to C Ignore arrows and any additional paths shown		1		1		
	(b)		Distance = $4 \times 36\,000$ [km] (1) = 144 000 k[m] (1) = 144 000 000 [m] (1) N.B. Conversion mark can be awarded on incorrect calculations even 36 000 000 Answer of 1.44×10^{n} where n is not equal to 8 award 2 marks		3		3	3	
	(c)		$\text{Speed} = \frac{\text{distance}}{\text{time}} = \frac{144\,000\,000\textbf{ecf}}{0.48}$ or $\frac{36\,000\,000}{0.12}$ or $\frac{72\,000\,000}{0.24}$ (1) = 300 000 000 [m/s] (1)	1	1		2	2	
			Question 5 total	**1**	**5**	**0**	**6**	**5**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
6	*(a)*	(i)	45.5 **or** 46 [°C]		1		1	1	1
		(ii)	5.0 [cm^3]		1		1	1	1
		(iii)	A is bigger than B **or** A is steeper than B **Don't accept** - they have different gradients or they're both positive		1		1		1
	(b)	(i)	Absolute zero	1			1		
		(ii)	333 [K]		1		1	1	1
	(c)		Pressure increases	1			1		1
	(d)	(i)	$P = \frac{F}{A} = \frac{180\,000}{1.5}$ (1) = 120 000 [Pa] (1)	1	1		2	2	2
		(ii)	Using the equation: $P = \frac{F}{A}$ **or** if you <u>divide by</u> double the area (1) the force will need to double (1) so she is incorrect. To award both marks conclusion must be present.			2	2		
			Question 6 total	**3**	**5**	**2**	**10**	**5**	**7**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
7	*(a)*			Windows at 15% 4 correct **3 marks** Floor at 10% 2 or 3 correct **2 marks** Roof at 25% 1 correct **1 mark** Walls at 35% 0 correct **0 mark**		3		3	1	
	(b)	(i)		Fibre-glass is an insulator **or** it contains air **or** it contains air pockets **or** reduces conduction through the ceiling (1) **Don't accept** traps air Reduces convection currents in the loft **or** air in the loft heats up less (1)	2			2		
		(ii)		**3 × (1):** Ticks in boxes alongside statements 2, 4 and 5 i.e. The required thickness of loft insulation in 2000 is 8 times thicker than in 1970. A house built in 1980 needs 210 mm of loft insulation added to bring it up to 2015 standards. The general trend of the graph indicates that the thickness of required loft insulation has increased at an increasing rate. Deduct 1 mark for each additional tick		3		3	3	
		(iii)		$4.50 \times 120 = £540$ (1) $\frac{540}{98} = 5.51$ or 5.5 or 6 [years] (1) **Don't accept** 5 [years] Answer of 0.0459 [years] award 1 mark only		2		2	2	
		(iv)		**(1) for either calculation:** Insulation 1 saving $(40 - 5.0) \times £84 = £2\,940$ Insulation 2 saving $(40 - 6.0) \times £111 = £3\,774$ **(1) for second calculation and comment/agreement with builder** **Alternative 1:** **(1) for either calculation:** $5 \times 84 = £420$ **and** $40 \times 84 = £3\,360$ **and** the difference = £2 940 $6 \times 111 = £666$ **and** $40 \times 111 = £4\,440$ **and** the difference = £3 774 **(1) for second calculation and comment/agreement with builder**			2	2	1	

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
				Alternative 2: 5 × 84 = £420 **and** 6 × 111 = £666 **or** 40 × 84 = £3 360 **and** 40 × 111 = £4 440 (1) The differences are £3 774 **and** £2 940 so the builder is correct (1) **Alternative 3:** **(1) for either calculation:** 3.5 × 120 = £420 **and** 40 × 84 = £3 360 **and** the difference = £2 940 5.5 × 120 = £666 **and** 40 × 111 = £4 440 **and** the difference = £3 774 **(1) for second calculation and comment/agreement with builder** **Alternative 4:** 3.5 × 120 = £420 **and** 5.5 × 120 = £666 **or** 40 × 84 = £3 360 **and** 40 × 111 = £4 440 (1) The differences are £3 774 **and** £2 940 so the builder is correct (1) **Alternative 5:** **(1) for either calculation:** (111 – 84) × 40 = £1 080 **or** 666 – 420 = £246 £1 080 – £246 = £834 **(1) and comment/agreement with builder** N.B. Any reference to insulation 3 treat as neutral						
				Question 7 total	**2**	**8**	**2**	**12**	**7**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
8	*(a)*	(i)		Repeat measurements **OR** measure more than 1 wavelength **Don't accept** reference to the ruler or more accurate ripple tank			1	1		1
		(ii)		Wave speed is [directly] proportional to wavelength (1) As wave speed 2 times faster in deep water **or** 2 times slower in shallow water (1) so teacher is incorrect **Alternative 1:** Candidates may make up a freq and use it on both sides e.g. 4 Hz In shallow water $4 \times 5 = 20$ [mm/s] **and** in deep water $4 \times 10 = 40$ [mm/s] (1) As wave speed 2 times faster in deep water **or** 2 times slower in shallow water (1) so teacher is incorrect **Alternative 2:** Wave in deep water travels double the distance (1) in the same time compared to shallow water (1) so teacher is incorrect N.B. To award both marks conclusion must be present. **Award 1 mark only** Waves in shallow water travel slower than waves in deep water so teacher claim is incorrect			2	2	2	2
	(b)	(i)		Total internal reflection accept TIR	1			1		
		(ii)		Light [ray directed] from high density to low density (1) Angle [of incidence] > critical angle **or** angle [of incidence] > 42^{o} (1)	2			2		
		(iii)		CT scans are ionising **or** X-rays are ionising (1) and [X-rays] mutate cells / cause cancer (1) **OR** [Endoscope uses] light that is not ionising (1) and [light] doesn't mutate cells / doesn't cause cancer (1)	2			2		
				Question 8 total	**5**	**0**	**3**	**8**	**2**	**3**

FOUNDATION TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	5	0	0	5	0	0
2	3	2	3	8	0	0
3	8	3	4	15	6	0
4	5	9	2	16	4	16
5	1	5	0	6	5	0
6	3	5	2	10	5	7
7	2	8	2	12	7	0
8	5	0	3	8	2	3
TOTAL	**32**	**32**	**16**	**80**	**29**	**26**