GCSE MARKING SCHEME

SUMMER 2016

SCIENCE - PHYSICS P1
4463/01/02

INTRODUCTION

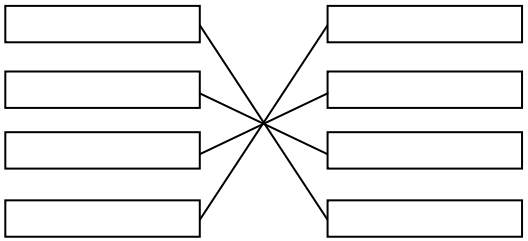
This marking scheme was used by WJEC for the 2016 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' 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 SCIENCE - PHYSICS P1

SUMMER 2016 MARK SCHEME

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
1			i		3	4 correct → 3 marks 3 correct→ 2 marks 1 or 2 correct → 1 mark 0 correct → 0 marks 			2 lines from any feature to any cause.
			ii		1	Big Bang			
		Total			**4**				

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
2		(a)	i		2	4 (1) 20 (1)			
			ii		3	Plots ± ½ small square division (2) -1 mark for each incorrect plot to a maximum of 2 Straight line through origin – no tolerance (1)	**ecf** for the input voltage value "4" for plotting treated as an anomalous point when drawing line If all points are misplotted can award **ecf** for line mark		Thick, whispy, double, wobbly lines
			iii		2	Input voltage increases so does output (1) It doubles (1) Award 1 mark for - [Directly] proportional to each other	Positive correlation = 1 mark When the input voltage increases by 1 the output voltage increases by 2 = 2 marks Output = 2 × input (award 2 marks)		Linear unless qualified
			iv		1	C			
			v		1	A			
		(b)			2	Decreases voltage (1) To make it safe[r] (1) **The 2nd mark needs to be linked to the 1st mark**	For safety reasons Less dangerous Step down voltage	References to energy and power Increases the current	Decreases the electricity
		Total			**11**				

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
3		(a)	i		2	1 000 [J] in rotating turbine (1) 300 [J] heats the air (1) **ecf on 1st answer - 700**			Negative answer
			ii		1	700 [J]			
			iii		2	Subs: $\frac{700}{2\,000}$ (1) **no ecf from (ii)** Ans = 35 (1)	0.35 (1)		
			iv		1	65 **ecf** Accept 65 even if answer to (iii) is incorrect	0.65		
		(b)			2	[Burning gas adds to] - greenhouse emissions / global warming [effect] / release of CO_2 (1) Limited resource / non-renewable / finite source (1)		Reference to cost Not very efficient Gas is a fossil fuel Reference to pollution	Acid rain
		Total			**8**				

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
4		(a)	i		1	6 [units]	-6		
			ii		1	8			
		(b)	i		1	[40] cycles / vibrations / oscillations <u>per second</u>	[40] waves/s or vibrations/s		Hz/s
			ii		2	Subs: 40×120 (1) Ans = 4 800 [m/s] (1)			
		(c)			2	Subs: $\frac{150\,000}{750}$ (1) Ans = 200 [m/s] (1)			
		Total			**7**				

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
5		(a)			2	Ticks by ultraviolet (1) and X-rays (1) Deduct 1 mark for each extra tick to a maximum of 2 marks			
		(b)	i		1	Gamma			
			ii		1	Gamma			
		(c)			2	Reference to containment (1) Long term storage (1)	Long half-life / long time to <u>decay</u> / thousands of years to <u>decay</u> (1) Deep underground (1)	Security Monitoring Cost Leaks Highly penetrating	Highly radioactive / emits radiation / hundreds of (or many) years to decay / lasts for a long time / decompose
		Total			**6**				

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
6	**1**	(a)	(i)		3	<table><tr><td></td><td>Volume (cm^3)</td><td>Mass (g)</td></tr><tr><td>oil</td><td>35</td><td>28 (1)</td></tr><tr><td>water</td><td>50 (1)</td><td>50 (1)</td></tr></table>			
			(ii)		3	Density of oil = $\frac{28(ecf)}{35}$ (1) = 0.8 (1) Correct unit of g/cm^3 given (1)	If 102 used then answer is 2.9[1] = award 2 marks **ecf** Accept kg/m^3 if mass and volume have been converted correctly		g/ml answer rounded to whole number
		(b)	(i)		2	ADVANTAGES: smaller than wind turbines / have a bigger power output or energy output / water is denser than air (1) [more] reliable output / water is always flowing (1)	Always a tide / not always wind	Reference to cost / visual or noise pollution / takes up less space / less needed	
			(ii)		2	DISADVANTAGES: danger to sea animals or shipping or sea lanes (1) [more] difficult / expensive to maintain / erect / build (1)	Ships could damage turbine Damage underwater habitats Problems for sea life	Could rust Barnacle build up is a problem Damage to sea bed Sea life or fish damaging the turbine	
		Total			**10**				

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
7	**2**	(a)			2	Only water above it is heated (1) Because hot water rises or is less dense / due to convection (1) **The 2nd mark must be linked to the 1st mark.**	Water below the heater can't get hot = 1st mark	Hot water expands / particles move further apart	Heat rises Hot air rises
		(b)	(i)		2	Foam / air is a [good] insulator or poor conductor (1) Because it has <u>trapped</u> air inside it (1) **The 2nd mark must be linked to the 1st mark.**	Pockets of air Reduces convection currents <u>outside</u> (1) because the outer temperature is lower (1)		Harder for heat to travel through air Air holes
			(ii)		2	Shiny surfaces are <u>poor emitters</u> (1) of <u>heat radiation</u> (1)	Infra-red instead of heat radiation Poor radiator of heat = 2 marks Reflect infra-red radiation back in (1)		Reflects heat back in
		(c)			2	Less electricity used / fewer power stations will be needed (1) which means less fuel (or a named fuel) is used or mined / less pollution (in any terms) is emitted from the power stations (1) **The 2nd mark must be linked to the 1st mark.**		The atmosphere heats up less	Reference to the ozone layer
		(d)			6	**Indicative content:** **Heater 1**: $4 \times 0.5 = 2$ [kWh] Cost = $2 \times 16 = 32$ p **Heater 2:** $2 \times 3 = 6$ [kWh] Cost = $6 \times 5 = 30$ p Heater 1 is 2 p more expensive than heater 2. **Heater 1:** $E = Pt = 2$ [kWh] **Heater 2:** $E = Pt = 6$ [kWh] Heater 2 uses up to 3 times more energy than heater 1 there is a 4 kWh difference. This will have an impact on the environment as more natural energy resources will be used up, more pollution/is produced which increases the greenhouse effect.			More water used up.

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
						5-6 marks **See indicative content – correct calculation for both heaters and a full comparison made** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** **Calculation of units used and costs for both, comparison between the two made with advice to householder – all 3 attempted or 2 done well** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** **Calculation of units used for both or one correct or some commentary provided** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.			
		Total			**14**				

Question Number					Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT	Sub-section							
	3	(a)	(i)		3	All points correctly plotted ± ½ small square division (2) -1 mark for each incorrect plot to a maximum of 2 Smooth curve through the points (1)			A series of straight lines, fuzzy or thick lines
			(ii)		1	2 [minutes]			
			(iii)		1	5 [^{o}C]			
		(b)	(i)		2	Points correctly plotted with coordinates (0,35), (2,20) and (4,10) ± ½ small square division (1) Smooth curve through the correct points within ± ½ small square division (1)	<u>If no points plotted allow curve</u> from (0,35) to (4,10) award 1 mark only		Smooth curve through incorrect points
			(ii)		3	A greater temperature (1) difference [between the can and its surroundings] (1) results in more heat loss per second or per unit time (1) **For 3 marks to be awarded, the 1st and 2nd marks must be linked to the 3rd mark.**			Greater heat
		(c)			4	8 μm chosen (1) used as 8×10^{-6} m (1-conv), $f = \frac{3 \times 10^{8}}{8 \times 10^{-6}}$ (1- manip and sub) f = 3.75×10^{13} [Hz] (1- ans) **Powers of 10 slip on λ deduct 1 mark**	Using 10 μm gives an answer of 3×10^{13} Hz award 3 marks (only one error has been made) Using 9 μm gives an answer 3.33×10^{13} Hz award 2 marks		Wavelengths of 18 μm and 2 μm no marks Any other wavelength chosen no marks
		Total			**14**				

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	4	(a)			2	Responds to changes in demand / copes with power station failures (1) by bringing reserve or backup stations [online] (1)		Peak times	
		(b)			3	$\frac{2 \times 10^8}{400\,000} = 500$ [A] (1 – manip. & subs.), (1-conversion from 400 kV to 400 000) (1- ans) **Alternative:** Input current calculated = 4 000 [A] (1) Voltage ratio is 1:8 **and** current ratio is 8:1 (1) so = 500 [A] (1)	Incompatible units to give an answer of 5×10^n gets 2 marks		
		(c)			3	Transmission at 50 kV would produce a greater current [through the grid] (1) resulting in a bigger power/heat/energy loss [in the cables] (1) The energy wasted in the two transformers is less than the energy that would be wasted from operating at a lower voltage with no transformers (1) **All three marks can only be awarded if the 3rd mark is linked to the first two marks.**	Converse argument		Prevent heat loss
		Total			**8**				

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
	5	(a)	(i)		1	[2 000 – 400] = 1 600 [cpm]			
			(ii)		1	Gamma	γ		
		(b)	(i)		1	0 [cpm]	zero / none		
			(ii)		2	**Can gain credit even if (b)(i) is non-zero.** Beta can't pass through aluminium (1) And aluminium does not alter the count rate compared to paper / so count rate would have dropped if beta was present (1) **The 2nd mark must be linked to the 1st mark.**	If beta was present, the count rate would have dropped beyond aluminium = 2 marks		
		(c)			1	Background radiation has already been taken away or is not included			
		Total			**6**				

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	6	(i)			1	4×10^9 years / 4 billion years			Light years
		(ii)			1	0.2×10^{-7} [m] or 2×10^{-8} [m]			
		(iii)			6	**Indicative content:** The chemical composition of stars in galaxies can be found by studying the absorption lines in their spectra. There are more lines in the spectrum from the distant galaxy which suggests that it contains more than just hydrogen because each black line represents a wavelength that is absorbed by additional elements. Light from the distant galaxy shows that the lines in its spectrum are red shifted when compared with those of laboratory hydrogen, that is, the lines have moved to the red end of the spectrum and their wavelengths have increased. This red shift shows that the separation this galaxy is from us is increasing. (Candidates who go on to discuss the expansion of the Universe, the existence of CMBR and the Big Bang theory should be penalised). **5-6 marks** **See indicative content – composition and distance both covered** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.			

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
						3-4 marks – either composition or distance covered well or attempt made at both The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks – attempt made at either composition or distance** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.			
		Total			**8**				