



GCSE MARKING SCHEME

SCIENCE – PHYSICS (NEW)

JANUARY 2012

INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2012 examination in GCSE SCIENCE – PHYSICS (NEW). They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were 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 conferences was to ensure that the marking schemes were 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' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

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UNIT P1

FOUNDATION TIER

Question		Answer / Explanatory Notes	Marks Available
1.	(a)	D B A All correct → (2); Any 1 correct (1)	2
	(b)	3 reasonable points (must be clear if referring to Nuclear or Coal) from: Commissioning costs (Nuc) Nuclear - away from population Running costs (incl. fuel) Transport costs (coal) Decommissioning costs (Nuc) Coal running out Security Background radn ⁿ Pollution (Coal) Space to store rad waste (nuc)	3
			5
2.	(a)	Order of insertion: Infra-red (1) X-rays (1)	2
	(b)	(i) the same as (1) (ii) less than (1) (iii) greater than (1)	3
	(c)	(i) 3 (1) (ii) C (1) (iii) At least 1 complete cycle drawn with larger amplitude (1) and smaller wavelength (1) [accept separate diagram if clear].	4
			9
3.	(a)	Mars	1
	(b)	(i) approx - 67 (°C) [accept 0 to -100°C] (ii) CO ₂ (1) Greenhouse effect / heat trapped in Earth (1) [accept converse e.g. no atmosphere <u>on Mercury</u> (1), so no greenhouse effect (1)] 2 nd mark must link to 1 st mark.	1 2
			4

Question		Answer / Explanatory Notes	Marks Available
4.	(a)	Correct statements – 3 × (1) Burning gas in a power station adds to global warming Wind turbines produce no air pollution Oil is a non-renewable source [Additional ticks – 1 for each]	3
	(b)	(i) 20,000 (J)	1
		(ii) Heat / thermal (1), sound (1) – 1 any additional types [Light – neutral]	2
			6
5.	(a)	they get a spectrum [of the star] / splits the light up	1
	(b)	<u>absorption</u> in the star's atmosphere	1
	(c)	<u>New</u> dark lines observed – identified as new element (He) [“New” or “unknown” lines/element]	1
	(d)	(i) lines moved (1) so they have a larger wavelength / towards red end of spectrum [implies 1 st mark] (1) (“redshifted” 2 marks – but <u>not the spectrum becomes redder</u>)	2
		(ii) Because the universe is expanding / because the galaxy [accept: “Star”] is moving away	1
			6
6.	(i)	speed = $\frac{2(1) \times 98}{0.56}$ (1) = 350 (m/s) (1) [NB lack of × 2 → 2 max] [175 m/s → (2)]	3
	(ii)	$v = 260 \times 1.3 = 338$ m/s [subst in $v = f\lambda$ (1); answer (1)]	2
	(iii)	Any 1 sensible answer from: <ul style="list-style-type: none"> • air movement • inaccuracy of only doing 1 measurement • inaccuracy of timings (starting/stopping stopwatch) / reaction times • distraction from other noises 	1
			6

Question			Answer / Explanatory Notes	Marks Available
7.	(a)	(i)	22%	1
		(ii)	[Loft / roof] insulation (accept silver foil on inside of tiles, fibreglass, rockwool)	1
		(iii)	Two appropriate points: Insulator (1) because it has trapped air (1) or reflects [heat] radiation (1) back in (1) [Reference to convection (1) with linked reason, e.g. temperature at bottom of roof space is lower (1)] 2 nd mark must link to the first mark.	2
	(b)	(i)	20 (years)	1
		(ii)	Shorter payback time / Save more [per year] [or equiv] / walls lose most heat	1
				6
8.	(a)		4.4	1
	(b)		10 (count/s) (1) Any 1× (1) from: All radiation from source stopped by paper, [so only background remains] / Graph flattens at 10 units / accept cand. showing on graph	2
	(c)		β / beta (1) α is stopped by [thin] paper [but β is not] / γ would not show any attenuation [however expressed] [accept any correct and relevant reference to different penetration.] (1) [2 nd mark only available if 1 st mark is given.]	2
				5

Question		Answer / Explanatory Notes	Marks Available
9.	(a)	<p>Any 2 × (1) from</p> <ul style="list-style-type: none"> • Supply to grid can vary to match demand ✓ • all power stations connected to grid ✓ • can cope if one breaks down. ✓ 	2
	(b)	<p>Indicative content: Transformers are used to step-up voltage, resulting in decreased current so less energy loss along cables. Then step-down transformer reduces voltage to consumer, because high voltages are dangerous in the home. The use of step-up and step-down transformers makes for more-efficient energy transfer.</p> <p>5 – 6 marks 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.</p> <p>3 – 4 marks 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.</p> <p>1 – 2 marks 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.</p> <p>0 marks The candidate does not make any attempt or give a relevant answer worthy of credit.</p>	6
10.	(i)	<p>A = 700 kWh Conversion to kW (1) Answer (1) [700 → 2 marks; 700000 → (1)] B = [£]84 (1) [e.c.f. from A, if 8400 must be 8400 p]</p>	3
	(ii)	<p>Cost of buying 5 CFL = [£]12.50 (1) [no e.c.f.] Total cost for 5 CFLs = [£]96.50 (1) [e.c.f. from B, allow 9650]</p>	2
Total marks for Foundation Tier			8
Total marks for Foundation Tier			60

HIGHER TIER

Question		Answer / Explanatory Notes	Marks Available
1.	(i)	$\text{speed} = \frac{2(1) \times 98}{0.56} \quad (1) = 350 \text{ (m/s) (1) [NB lack of } \times 2 \rightarrow 2 \text{ max]}$ [175 m/s \rightarrow (2)]	3
	(ii)	$v = 260 \times 1.3 = 338 \text{ m/s}$ [subst in $v = f\lambda$ (1); answer (1)]	2
	(iii)	Any 1 sensible answer from: air movement <ul style="list-style-type: none"> • inaccuracy of only doing 1 measurement • inaccuracy of timings (starting/stopping stopwatch) / reaction times • distraction from other noises 	1
6			
2.	(a)	Any 2 \times (1) from <ul style="list-style-type: none"> • Supply to grid can vary to match demand ✓ • all power stations connected to grid ✓ • can cope if one breaks down. ✓ 	2
	(b)	(i) substitution(1), matching units (award 1 mark even if eq incorrect), e.g. 950 000 000/25 000, ans 38 000 (A) (1 mark – allow ecf from non matching units, e.g. 38 \rightarrow (2)]	3
	(ii)	<p>Indicative content: Transformers are used to step-up voltage, resulting in decreased current so less energy loss along cables. Then step-down transformer reduces voltage to consumer, because high voltages are dangerous in the home. The use of step-up and step-down transformers makes for more-efficient energy transfer.</p> <p>5 – 6 marks 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.</p> <p>3 – 4 marks 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.</p> <p>1 – 2 marks 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.</p> <p>0 marks The candidate does not make any attempt or give a relevant answer worthy of credit.</p>	6
11			

Question		Answer / Explanatory Notes	Marks Available	
3.	(a)	4.4	1	
	(b)	10 (count/s) (1) Any $1 \times$ (1) from: All radiation from source stopped by paper, [so only background remains] / Graph flattens at 10 units / accept cand. showing on graph	2	
	(c)	β / beta (1) α is stopped by [thin] paper [but β is not] / γ would not show any attenuation [however expressed] [accept any correct and relevant reference to different penetration.] (1) [2 nd mark only awarded if first mark is given]	2	
			5	
4.	(i)	A = 700 kWh Conversion to kW (1) Answer (1) [700 \rightarrow 2 marks; 700000 \rightarrow (1)] B = [£]84 (1) [e.c.f. from A, if 8400 must be 8400 p]	3	
	(ii)	Cost of buying 5 CFL = [£]12.50 (1) [no e.c.f.] Total cost for 5 CFLs = [£]96.50 (1) [e.c.f. from B, allow 9650]	2	
	(iii)	Both emit same light output (1), power used by led is less than cfl (1), 14/6 or or 2.33 times less (1) [3 rd point implies 2 nd] [accept converse argument]	3	
			8	
5.	(a)	(i)	[atoms of a] gas <u>absorb</u> light at specific wavelengths...(1) light passes through gas / lines are characteristic of the elements in the gas. (1) NB 2 nd mark must link to the 1 st .	2
		(ii)	[Chemical] composition / make-up of [the atmosphere of] the star or equiv. Or – speed of recession of the star / galaxy	1
	(b)	For distant galaxy: lines would be further red shifted [Or the wavelengths of the lines would be larger in the distant galaxy] (1), galaxy moving away faster. [or because the universe has expanded more since the radiation from the first galaxy was sent out](1) NB 2 nd mark must link to the 1 st .	2	
	(c)	(i)	Sensible scales [linear, points occupying at least half the grid] (1) Accurate plots [within $\frac{1}{2}$ a minor scale division] (1) Good line of best fit – drawn using a ruler (1) [independent mark]	3
		(ii)	The recession speed is [directly] proportional to the distance [or, e.g. if the distance doubles the speed doubles](2) [The greater the distance the greater the recession speed , or positive correlation \rightarrow (1)]	2
		(iii)	matter ‘expelled’ from a Big Bang (1) Galaxies must have come from one point / back in time must have been closer together (1) 2 nd mark must link to 1 st .	2
			12	

Question		Answer / Explanatory Notes	Marks Available
6.	(a)	<p>Any 2 × (1) from:</p> <ul style="list-style-type: none"> • High cost✓ • [Relatively] low power output / produces less electricity ✓ • so a long payback period ✓ • Intermittent ✓ 	2
	(b)	<p>(i) Any 1 × (1) from:</p> <ul style="list-style-type: none"> • Reduced energy / electricity bills [for the householder] ✓ • [Generous] feed-in tariffs ✓ <p>Any 1 × (1) from</p> <ul style="list-style-type: none"> • Reduced burning of fossil fuels ... ✓ • ...so reduction in greenhouse gas / CO₂ [accept acid rain] emission ✓ [1 mark only for an air-pollution effect] <p>+ 1 × (1) for any other bullet point.</p>	3
		<p>(ii) trees/plants absorb take in as much CO₂ (1) as they give out [when burnt] (1)</p>	2
	(c)	<p>Naming any one method, e.g. loft insulation / cavity wall insulation / double glazing / draft excluders (1)</p> <p>Description of how reduction achieved for that method in terms of conduction, convection or radiation (1)</p> <p>More detail in energy transfer explanation (1)</p> <p>NB 2nd and 3rd mark must link to 1st mark.</p>	3
			10

Question		Answer / Explanatory Notes	Marks Available
7.	(i)	Any 2 × (1) from <ul style="list-style-type: none"> • Travel though a vacuum ✓ • Transverse waves ✓ • Travel at same speed [through space] ✓ • Transfer energy or information ✓ • Other wave property, e.g. reflection, refraction, interference ✓] • 	2
	(ii)	<p>Indicative content: The Earth absorbs sunlight, eventually radiates energy [or heat] back out. Some of this radiation makes it into space. The rest of it ends up getting absorbed in the atmosphere, by carbon dioxide, methane gas and water vapor. After these components in our atmosphere absorb all this heat, they re-emit energy (also in the form of radiation / heat). The heat that doesn't make it out through Earth's atmosphere keeps the planet warmer than it would be without the atmosphere.</p> <p>5 – 6 marks 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.</p> <p>3 – 4 marks 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.</p> <p>1 – 2 marks 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 many inaccuracies in spelling, punctuation and grammar.</p> <p>0 marks The candidate does not make any attempt or give a relevant answer worthy of credit.</p>	6
			8
Total for higher tier paper			60



WJEC
245 Western Avenue
Cardiff CF5 2YX
Tel No 029 2026 5000
Fax 029 2057 5994
E-mail: exams@wjec.co.uk
website: www.wjec.co.uk