



MS2
£2.00

GENERAL CERTIFICATE OF SECONDARY EDUCATION
TYSTYSGRIF GYFFREDINOL ADDYSG UWCHRADD

MARKING SCHEME

PHYSICS
SCIENCE UNIT P1
ADDITIONAL SCIENCE UNIT P2

JANUARY 2008

INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2008 examination in GCSE Physics Units for Science, Additional Science & Physics. 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.

Physics 1

F H	Answer / Explanatory Notes		Marks Available
1.	Box 1 → Box 4 [Geothermal] (1) Box 3 → Box 3 [Biomass] (1) Box 4 → Box 5 [Wave energy] (1) [additional lines –1]		3 3
2.	(a) (i) (ii) (iii) (b)	C [accept D] C A Optical fibres or other suitable answer / e.g. endoscope, communication. [Accept use of domestic renewable energy source for 1 mark Solar wind heat exchanger	1 1 1 1 4
3.	(a) (i) (ii) (b)	radiation radiation Any 2 × 1 from: turn down thermostat [or heating] / fit double glazing / hang or close curtains / draft excluders / insulate the loft etc. [not close the doors / windows / turn heating off]	1 1 2 4
4.	(a) (i) (ii) (b) (i) (ii)	Helium fusion gravity /gravitation / gravitational force stable [state] [not doesn't move] accept – doesn't get bigger or smaller.	1 1 1 1 4
5.	(a) (i) (ii) (b) (i) (ii) (c)	8 3 [e.c.f. from (i)] 28 [not 28000] E Communications, weather or TV or telephones [if qualified], spying etc / space telescope /looking into space / sat nav / GPS [TomTom or Garmin wuth qualification]	1 1 1 1 1 5
6.	(a) (b) (i) (ii) (c)	Indication that wind strength fell [accept answer in terms of power output] 270 MW $\text{Efficiency} = \frac{270}{650} [\text{e.c.f.}] [\times 100\%] (1 - \text{subst}) = 41.5\% (1 - \text{ans})$ Accept 42% [2 marks] 41% [1 mark] hydroelectric, solar, geothermal, wave.... biofuel, tides, sun [accept hydro]	1 1 2 1 5

F H		Answer / Explanatory Notes	Marks Available
11 2	(i) (ii) (iii) (iv)	4 units 10 cycles number of waves (produced) in 1 second [accept 50 “wavelengths” in one second] $\text{Wavelength} = \frac{\text{wavespeed}}{\text{frequency}} \quad (\text{any form})$ $\text{Wavelength} = \frac{5000}{50} (1) = 100\text{m} (1)$	1 1 1 2 6
12 3	(a) (b)	336 (1) and 10 (1) in the table. traps / contains air (1) which is a good insulator (1) poor conductor [No free electrons → 1 mark]	2 2 4
4	(a) (b) (c)	(i) Power = voltage × current or $\text{current} = \frac{\text{power}}{\text{voltage}} (1\text{manip}) \frac{200\,000\,000}{400\,000} (\text{subst}) (1)$ <p>or</p> $200\,000\,000 = 400\,000 \times \text{current} (1 - \text{subst})$ $\text{current} = \frac{200\,000\,000}{400\,000} (1 - \text{manip}) = 500 \text{ A}$ (ii) voltage reduced by (factor of) 8 so current increases by 8 times (1) [or by calculation] [accept current of 4000 A]	1 2 1 2 1 2 9

5	(a)	Units used = power (kW) × time (h) (1) [accept without units] Units used = 0.02×15000 (1) = 300 (1)	1 2	
	(b)	Units used = $0.1 \times 15\ 000 = 1500$ (1)	1	
	(c)	Cost = units used × cost per unit	Or $300 \times 10\text{p} = \text{£}30$	1
		Money saved = $1200[\text{e.c.f.}] \times 10\text{p}$ (1) = $\text{£}120$ (1)	$1500 \times 10\text{p} = \text{£}150$	2
		Methodology [i.e. postscales] (1) Accuracy (1)	$\text{£}120$	
(d)	48 Division or 48 ecf (1)	1		
(e)	Reduced use of fuels / less energy used (1), reduced number of power stations needed (1) Reduced emissions of CO_2 into atmosphere / global warming (1) Reduction in material used in making bulbs (1) Reduced use of landfill (1) SO_x / acid rain reduction (1)	3 11		

F H		Answer / Explanatory Notes	Marks Available
6	(a)	(i) In the first diagram [All] lines moved (1) to the red / longer wavelength end [of spectrum] (1) [Allow spectrum stretched] (1) N.B. "light red shifted" → 1 mark "Spectrum stretched" → 1 mark (ii) moving away from us (iii) Universe is expanding / moving out from a point	2 1 1
	(b)	(i) Lines further towards the red / longer wavelength / greater red shift (ii) Galaxies moving faster	1 1 6
7	(a)	$\text{speed} = \frac{\text{distance}}{\text{time}}$ subst / manip (1) Factor of 2 (1) Answer 2 obs (1)	1 3
	(b)	(i) Ray shown directly from A→B (1 only) Rays from A→B, shown reflected off point between A and B or 2 reflections (2) (ii) [Totally] internally reflected accept TIR (iii) Angle bigger than critical angle or bigger than 42-48° (for glass) (1) and directed from a more to a less dense medium [or from low speed to high speed of light material] (1) N.B. (ii) and (iii) marked together.	2 1 2 9

F H	Answer / Explanatory Notes		Marks Available
1.	(i) (ii) (iii)	2 [m/s] 8 [m/s] 30 [s]	1 1 1 3
2.	(i) (ii) (iii)	insulation Earth miniature	1 1 1 3
3.	(a) (b)	(i) 50% [correct answer only] not ½ (ii) cosmic [rays] (iii) radon [gas] (i) Finland (ii) Sweden	1 1 1 1 1 5
4.	(a) (b)	(i) voltmeter [not: voltameter] (ii) ammeter [not : ampmeter, amp meter] (i) Plots (2); line (1) [no penalty for no (0,0) – line must go through (0,0)] Not: Double or rough lines. (ii) 4 V e.cf., i.e the reading from the graph. (iii) $\frac{\text{answer to (ii)}}{1}(1) = \text{numerical ans to (ii)} [\Omega] (1)$	1 1 3 1 2 8
5.	(a) (b) (c)	(i) Bismuth/Bi [accept 61 <u>minutes</u>] (ii) Polonium/Po or Bismuth/Bi (iii) Polonium/Po (i) Y (ii) X 100 (1); 24 (1)	1 1 1 1 1 2 4
6.	(a) (b) (c)	$\frac{420}{70}(1 \text{ subs}) = 6 \text{ m/s}^2 (1)$ (i) drag / <u>air</u> resistance / friction [not wind or wind resistance] (ii) Increases /stronger (iii) constant speed /steady speed / terminal velocity / no acceleration 420 × 100 (1) = 42 000 J (1)	2 1 1 1 2 7

F H	Answer / Explanatory Notes		Marks Available
F-tier 7. (a)	$\left[\frac{60}{230} = \right] 0.26 \text{ A (1 - ans) [accept 0.3 A]}$		1
(b)	$0.43 + 0.43 + 0.17$ [e.c.f.] [or equiv] (1) = 1.03 A (1) Or $\frac{240}{230}$ (1) = 1.04 A (1)		2
(c)	$\frac{5}{0.43}$ (1) → 11 (1). [must be rounded down]		2
6			
H-tier 1. (a)	$\text{Current} = \frac{\text{Power}}{\text{Voltage}}$ $\frac{60}{230} \text{ (1 - subst) = } 0.26 \text{ A (1 - ans)}$		1
(b)	$0.43 + 0.43 + 0.17$ [e.c.f.] [or equiv] (1) = 1.03 A (1) Or $\frac{240}{230}$ (1) = 1.04 A (1)		2
(c)	$\frac{5}{0.43}$ (1) → 11 (1).		2
(d)	Can be reset / quicker acting / more reliable / sensitive [any 2 × 1]		2
9			
8. 2 (a)	More chance of survival [in a collision] Or comparison of values at 20 m/s and 30 m/s [even without conclusion] [must be a reference to the graph]		1
(b)	(i) $5 \times 1.5 = 7.5 \text{ m}$ [method or answer]		1
(ii)	$\text{speed} = \frac{\text{distance}}{\text{time}}$ [any correct form]		1
(iii)	$\frac{7.5}{0.5}$ (1) = 15 m/s (1)		2
(iv)	32 - 36 mph [e.c.f.] 40 - 72% [e.c.f.]		1
If speed < 20 mph must be >96% survival If speed > 50 mph must be 0 survival.			1
7			

F H		Answer / Explanatory Notes	Marks Available
9. 3.	(i)	Reasonable health-related [harm] answer (1) [accept contamination/ harms environment] Reasonable decay time answer (1) [accept: still active after disposal]	2
	(ii)	Must be different answers. Any 3 × (1) from: 1. Implication of lack of containment 2. Seismic activity / water supply problems 3. Leakage / corrosion / cracking 4. Take off problems [explode / fall back to earth / re-enter atmosphere], cost [No reference to extra-terrestrials] 5. Ice sheets may melt / global warming 6. Island may be populated in future.	3
	(ii)	Any suitable responses [3 × 1]	5
4. (a)		X = voltmeter (1), Y = ammeter (1), Z = diode	3
	(i)	Up to ~0.6 V → zero current (1) [or equiv.] Current increases (with voltage) (1) non-uniformly (1)	3
	(ii)	Voltage = current × resistance 0.10 A (1) $\left[\text{Resistance} = \frac{0.7}{0.10} \right] = 7.0 \Omega (1)$	1
			2 9
5 (a)		$\Delta E_p = mg\Delta h$ [in words] Accept PE = mgh Increase in potential energy = $60 \times 10 \times 55 (1) = 33\,000 \text{ J} (1)$	1 2
	(i)	$33\,000 - 18\,000 = 15\,000 \text{ J} (ans) \text{ e.c.f.}$	1
	(ii)	Kinetic energy = $\frac{\text{mass} \times \text{speed}^2}{2}$; accept KE = $\frac{1}{2} mv^2$ $18\,000 = \frac{60 \times \text{speed}^2}{2} (1 - \text{subs or for manip eqn eg } v^2 = \frac{2KE}{m});$ speed = 24.5 m/s (ans)	1 2
	(c)	The weight / gravitational force is greater than (1) the air resistance (1)	2
	(d)	0 (1) 0 or 33000 J(1) [e.c.f. from (a)] 33 000 J (1) [e.c.f. from (a)]	3 12

F H		Answer / Explanatory Notes	Marks Available
6 (a)	(i)	The [radio]activity halves (1) in 25 minutes / this time (1) [or equiv.] Mass [of radioactive material] to halve.	2
	(ii)	Stable nucleus (1) because there is a balance (1) between the number of protons and neutrons (1) [any 2 from 3]	2
(b)	(i)	[Gamma] radiation detected outside body (1); suitable half life (1)	2
	(ii)	No. of half lives = 10 (1) [award for method of calculating no. of ½ lives] $\frac{1}{2^{10}}$ or $\frac{1}{1024}$ (1) [0.09765%]	2
			8



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/exams.html