OCR
RECOGNISING ACHIEVEMENT

Physics B (Advancing Physics)

Advanced GCE **H559**

Advanced Subsidiary GCE **H159**

Mark Scheme for the Units

June 2009

HX59/MS/R/09

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Advanced Subsidiary GCE Physics B (Advancing Physics) (H159)

MARK SCHEMES FOR THE UNITS

G491 – Physics in Action

Question	Expected Answers	Marks	Additional guidance
1 (a)	J s-1 ✓	1	not W accept J / s
1 (b)	A s ✓	1	not C
1 (b)	A V-1 ✓	1	not S accept A / V
2 (a)	B ✓	1	
(b)	response times in range 4 to 6 (s) ✓	1	method not any credit for gradient i.e. interpreting T as time not dependent / independent variables
(c)	ΔV / ΔT / 0.8 / 75 ✓ m	1	evaluation accept 0.01 allow 1.2 / 75 = 0.016 for 1 /2 marks unit mark standalone not ecf
	0.0107 / 0.011 ✓ e	1	
	V °C-1 ✓	1	
3 (a)	eg. possibly weakened when cut / possible dynamic / asymmetric loading / typographic error in this reading / reliability of spring balance used for the 4.5 N reading ✓	1	AW expect cause and sense of weakening accept any plausible practical point that could explain weakening eg. small tear in paper, wet paper, lower width, sample of different paper etc. not just repeat the readings / different length / just human error / random / systematic error / weak strip allow misreading of force-meter

Question	Expected Answers	Marks	Additional guidance
3 (b)	method: sensible attempt to find an average / mean = (2x6.5+3x7.0+7x7.5+10x8.0+4x8.5 +1x9.0+ 2x9.5)/29 / = 228.5 / 29 ✓ m = 7.9 ✓ ± 1.5 (N) ✓ e / = 8 ± 1 / 1.5 / 2 (N) by eye	1 2	allow 1 small error setting up mean then penalise evaluation eg. 220.5 / 29 = 7.6 N / 233 / 30 = 7.8 N not just take mean / average accept mention of selecting median / middle / modal value allow answers expressed to 1 or 2 SF accept ± 1.6 / 2 N penalise 3 or more SF once only in average or variability accept median = 8 / mode = 8 correct answers without any sensible method max 2/3
4	stiffness ✓ brittleness ✓	1 1	not Young modulus / stiff not brittle
5 (a)	losing higher frequency components ✓ / creates aliases / generates spurious low frequencies	1	accept AW / good quality before + after diagrams not less quality / missing details / frequencies / information / restatement of Nyquist
5 (b)	b = log2 (Vtotal / Vnoise) ⇒ b = 10.97 ✓	1	accept 10.9 / 10.96 allow 211 = 2048 ORA not any credit for only qualitative answers not just b = 11 must do a show that calculation
5 (c)	(at least 12 x 103 x 11) =1.3(2) x 105 (bit s-1) ✓	1	132 000 not any other values unless justified eg. a higher sampling f or stereo calculation

Question	Expected Answers	Marks	Additional guidance
6 (a)	(1350 / 45) = 30 ✓	1	accept correct answer without method not any other value
6 (b)	(u = v / M = 2.1 / 30) = 0.07(0) m ✓ P or 1 / f = 1 / 2.1 - 1/ (-0.07) ✓ = 14.76 (D) / 14.8 (D) ✓	1 1 1	accept either + / - signs for evaluation of u allow ecf on magnification from a eg. M = 0.033 ⇒ u = 63.6 m ⇒ P = 0.49 (D) for full marks method signs must be correct accept real is +ve convention allow ecf on incorrect u not any ecf on incorrect signs accept 1/ v small so P ≈ 1/ 0.07 ; = 14.(3) D for last 2 marks accept ORA i.e. using P = 15 D ⇒ u = 0.0688 m ≈ 0.07 m for max 2/3
7 (a)	B ✓	1	
7 (b)	A ✓	1	
	Section A total	**23**	

Question	Expected Answers	Marks	Additional guidance
8 (a)	(480 x 10 x 580 x 10) = 2 .784 x 107 (km2) ✓e	1	accept 2 .8 x 107 / 27 840 000 (km2) look out for powers of ten errors
8 (b) (i)	(255 x 33) = 8 415 (m) ✓ e	1	accept 8400 (m) / 8.4(2) x 103 (m) / 8.4(2) k(m) accept 8448 (m) (= 33 x 256)
8 (ii)	depth can vary within distance of 10 km ✓	1	accept depth can vary within pixel (size / length / area) must explain not just pixel represents area not depths quantised in 33m steps / wave / tidal variations
8 (c)	shallow water in range 2.2 to 2.7 km deep / cliff height in range 3.9 to 4.4 km / deep water up to about 6.6 km deep / drop off in range 800 to 1200 km (from W / E) ✓✓	2	accept any 2 quantitative estimates of distances not pixels quantitative aspect can be depth / distance estimate for one mark each or gradient for both marks
(d)	4 km deep is pixel value ≈ 121 / area under graph OR no. pixels ∝ area reqd ✓ area under graph to 121 or pixels up to 121 total area under graph total pixels ✓	1 1	accept ≈ 120 / 122 QWC penalise either mark for lack of clarity eg. confusing area under graph with area of seabed / 2 or more spelling errors across whole question place X on pen symbol if QWC penalty accept technical / mathematical symbolism
8 (e)	finds sudden changes in the gradient (of the greyscale values) ✓	1	accept AW but concept must be clear for H mark not just edge detection not just sudden changes in depth accept a complete correct mathematical description: eg. {this pixel value x 4 – (N + S + W + E)} / by diagram
	Total	**8**	

Question	Expected Answers	Marks	Additional guidance
9 (a) (i)	V = I R / = 0.25 x 5.8 ✓ m = 1.45 (V) ✓ e OR V = ε - I r ✓ m = 1.55–0.25 x 0.4 =1.45 (V) ✓e	2	accept 1.5 (V) allow other correct methods ORA
9 (ii)	energy is used / dropped driving current through the internal resistance ✓	1	accept p.d. / voltage / emf for energy accept other AW not just volts used up in cell / just mention of internal r
9 (b) (i)	current is constant for about 9 or 10 hours ✓ then falls rapidly / to zero over last few hours ✓ first 10 hours: internal r remains constant / cell	1 1	accept few = ½ to 2 hours if numerical values accept AW
(ii)	operates at constant e.m.f. ✓ last hour: cell's (chemical / potential) energy is used up (so ε or I fall) ✓ OR internal r increases (causing drop in operating p.d. or current) ✓	1 1	reasons for behaviour described not power is constant accept supply voltage is constant not just voltage constant accept cell polarises not cell runs out of power / current / emf / p.d. / charge
9 (iii)	est. no. squares ≈ 25 x 25 + 35 ≈ 660 ✓ m each graph square of charge = 10 x 10-3 x 2 x 3600 / 5 = 14.4 C ✓ m total charge delivered ≈ 9.5 kC ✓ e ≈ 2.6(4) Ah with C {9 kC from Q = 0.25 x 10 x 3600 scores 2/3} {10 kC from Q = 0.25 x 11 x 3600 scores 2/3}	1 1 1	method accept 655 to 665 method not any tolerance on this value if evaluated accept Q = Σ I Δt / area under graph / counting squares for 1 method mark in absence of any evaluation evaluation accept 9.4 to 9.6 kC / 9500 C / 9.5 x 103 C 3rd mark is for quality estimate within range above each extra error eg. power of ten / hr to s conversion -1 each accept Q = I t ⇒ 0.25 x (3600 x 10.5) = 9.45 kC full credit
	Total	**10**	

Question	Expected Answers	Marks	Additional guidance
10 (a) (i)	current limiting / protective resistor ✓ / prevent damage / overheating of LED / resistor to drop remainder of p.d. from the battery / to act as potential divider (with R of LED)	1	accept any one correct statement or AW not control resistor / to keep current constant not varying I or V or P not just to stop LED breaking / blowing
10 (a) (ii)	for correct use of VR = 9.0 – 2.1 = 6.9 V ✓m (R = V / I = 6.9 / 0.025) = 276 (Ω) ✓ e	1 1	part method evaluation accept 280 (Ω) allow 1 max on 360 Ω / 84 Ω values only allow full credit for correct potential divider method
10 (iii)	= 0.025 x 6.9 / ✓ s = 6.9 2 / 276 / = 0.025 2 x 276 = 0.17(3) (W) ✓ e	1 1	correct substitution allow ecf on incorrect VR from (ii) evaluation allow ecf on R value from ii eg. 360 Ω ⇒ 0.225 (W) / 84 Ω ⇒ 0.0525 (W) for 2 marks
10 (b) (i)	green LED starts to conduct at higher voltage than the red / at same current green LED drops more voltage/ at same voltage red LED draws more current ✓	1	look for difference accept AW quantitative not needed not green LED has higher voltage / power / resistance unless same current is specified not LEDs get brighter
(b) (ii)	red LED switches on first / green second ✓ red LED at 1.6 V green LED at 1.9 V / green takes more p.d to strike / excite / conduct / emit light / overcome barrier / threshold voltage ✓	1 1	statement accept red is brighter than green once both are on / red draws more current explanation accept because red draws more current (at same p.d. / in parallel) credit once only / because it has less resistance

Question	Expected Answers	Marks	Additional guidance
10 (iii)	total current = 5 + 20 mA / = 25 mA ✓	1	from graph accept 24 to 26 mA or two separate values from the graph totalling 24-26 mA.
	(G = I / V) = 0.025 / 7 = 3.6 X 10-3 (S) ✓	1	accept 3.57 m(S) allow ecf on incorrect current / 7 correctly evaluated
	Total	**10**	

Question	Expected Answers	Marks	Additional guidance
11 (a)	strong or 3-d bonding (makes fibres strong) ✓ no slip / no dislocation movement (to allow plastic flow) ✓ linked to because randomised orientations of ionic groups lack of short range order / directional bonding ✓	1 1 1	accept AW but must convey the sense can be in any order accept cracks propagate easily must be explicit link between 2nd & 3rd marks accept lack of regularity in structure / different sized atoms seize up the structure not just the glass is brittle
11 (b)	scratches (on surface) weakens material ✓ scratches have stress concentrations at their tips ✓ cracks propagate through material ✓ correct direction of bending is to open the crack ✓ (credit well annotated diagrams) causing brittle fracture along the length of scratch ✓ local stress cannot be relieved by slip / plastic flow or due to lack of short range order ✓	3	credit any 3 separate marking points QWC penalise absence of all / misspelling of any one of these technical terms: stress concentration / crack propagation / cracks propagate / brittle fracture place X on pen symbol if QWC penalty not glass is polycrystalline / has grains
11 (c)	in solid ions are locked rigidly in position ✓ near melting temperature ions gain mobility as glass softens ✓ in solid ions cannot flow / move to carry current / near melting temperature charge flows as ions can move ✓	1 1 1	accept AW but must convey the sense credit any 2 separate marking points max 1/3 for suggestions using free electron or charge carrier density increasing with temperature
	Total	**9**	
	Section B total:	**37**	