UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2010 question paper for the guidance of teachers

9702 PHYSICS

9702/22

Paper 2 (AS Structured Questions), maximum raw mark 60

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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	Page 2		2	Mark Scheme: Teachers' version	Syllabus	Paper	
				GCE A LEVEL – October/November 2010	9702	22	
1	(a)	(i)		ar quantity has magnitude (allow size) or quantity has magnitude and direction		B1 B1	[2]
		(ii)	2 . a	emperature: scalar cceleration: vector esistance: scalar		B1 B1 B1	[1] [1] [1]
	(b)	eith		triangle / parallelogram with correct shape tension = 14 .3 N (allow ± 0.5 N)		C1 A2	[3]
		or	T = T = T = R ar	(if > ± 0.5 N but ≤ ± 1 N, allow 1 mark) 25 cos 35° R tan 35° 14.3 N 25 sin 35° 14.3 N and T resolved vertically and horizontally ing to $T = 14.3$ N		(C1) (C1) (A1) (C2) (A1) (C2) (A1)	
2	(a)	(i)		= 12.4 cos 36° (= 10.0 m s ⁻¹) ance = 10.0 × 0.17 = 1.7 m		C1 A1	[2]
		(ii)	h = 7	= 1.7 m = 12.4 sin 36° (= 7.29 m s ⁻¹) 7.29 × 0.17 – $\frac{1}{2}$ × 9.81 × 0.17 ² 1.1 m		C1 C1 A1	[3]
	(b)			curve with ball hitting wall below original curve showing rebound to ground with correct reflection	n at wall	B1 B1	[2]
3	(a)			which (whole) weight (of body) (allow mass for weight (seems to act (for mass need 'appears to be conce		M1 A1	[2]
	(b)	(i)	poin	t C shown at centre of rectangle ± 5 mm		B1	[1]
		(ii)		w vertically downwards, from C with arrow starting frongin of error as in (b)(i)	n the same	В1	[1]
	(c)	(i)	fricti	etion / upwards / supporting / normal reaction force on e(s) at the rod		M1 M1 A1	[3]
		(ii)	allov	es to rest with (line of action of) weight acting through v C vertically below the rod nat weight does not have a moment about the pivot / ro		B1 B1	[2]

4 (a) energy = average force × extension $= \frac{1}{2} \times F \times X$ (Hooke's law) extension proportional to (applied) force hence $F = kx$ as $o E = \frac{1}{2}kkx^2$ A0 (b) (i) correct area shaded B1 (ii) 1.0 cm^2 represents 1.0 mJ or correct units used in calculation $E_3 = 6.4 \pm 0.2 \text{ mJ}$ (for answer $\Rightarrow \pm 0.2 \text{ mJ}$ but $\leq \pm 0.4 \text{ mJ}$, then allow $2/3$ marks) (iii) arrangement of atoms / molecules is changed B1 5 (a) (i) distance (of point on wave) from rest / equilibrium position B1 (ii) distance moved by wave energy / wavefront during one cycle of the source or minimum distance between two points with the same phase or between adjacent crests or troughs B1 (b) (i) $T = 0.60 \text{ s}$ B1 (ii) $\lambda = 4.0 \text{ cm}$ B1 (c) (i) amplitude is decreasing so, it is losing power A1 (ii) intensity $\sim (\text{amplitude})^2$ c1 $= 3.3$ A1 6 (a) (i) at 22.5 °C , $R_T = 1600 \Omega$ or $1.6 \text{ k}\Omega$ total resistance = 800Ω A1 (iii) either use of potential divider formula or current = $9/2000 (4.5 \text{ mA})$ V = $(0.8/2.0) \times 9$ = 3.6 V C1 (b) (i) total resistance = $4/5 \times 1200$ = 3.6 V C1 (c) (1) for parallel combination, $1/960 = 1/1600 + 1/R_T$ $R_T = 2400 \Omega/2.4 \text{ k}\Omega$ (C1 temperature = 11 °C A1	-	i age o	mark ocheme. Teachers version Synab	-		
(Hooke's law) extension proportional to (applied) force before $F = kx$ and $F = kx$ before			GCE A LEVEL – October/November 2010 9702	2 22		
(ii) $1.0 \mathrm{cm}^2$ represents $1.0 \mathrm{mJ}$ or correct units used in calculation $E_5 = 6.4 \pm 0.2 \mathrm{mJ}$ $(for answer > \pm 0.2 \mathrm{mJ})$ $but \le \pm 0.4 \mathrm{mJ}$, then allow $2/3 \mathrm{marks}$) (iii) arrangement of atoms / molecules is changed B1 5 (a) (i) distance (of point on wave) from rest / equilibrium position B1 (ii) distance moved by wave energy / wavefront during one cycle of the source or minimum distance between two points with the same phase or between adjacent crests or troughs (b) (i) $T = 0.60 \mathrm{s}$ (ii) $\lambda = 4.0 \mathrm{cm}$ (iii) $either v = \lambda / T$ or $v = f\lambda$ and $f = 1/T$ (c) (i) amplitude is decreasing so, it is losing power (ii) intensity ~ $(amplitude)^2$ ratio $= 2.0^2 / 1.1^2$ (c) $= 3.3$ (d) ii) at $22.5 ^\circ \mathrm{C}$, $R_T = 1600 \Omega$ or $1.6 \mathrm{k} \Omega$ total resistance $= 800 \Omega$ (iii) $either \mathrm{use} f$ potential divider formula or current $= 9 / 2000 (4.5 \mathrm{mA})$ or $V = (0.8/2.0) \times 9$ (iv) $= 3.6 \mathrm{V}$ (v) itotal resistance $= 4/5 \times 1200$ $= 960 \Omega$ (ii) total resistance $= 4/5 \times 1200$ $= 960 \Omega$ (iii) for parallel combination, $1/960 = 1/1600 + 1/R_T$ $R_T = 2400 \Omega / (2.4 \mathrm{k} \Omega$ C1	4	(Hoo	B1 B1 B1			
$E_8 = 6.4 \pm 0.2\mathrm{mJ} \ \ (for answer > \pm 0.2\mathrm{mJ} \ but \leq \pm 0.4\mathrm{mJ}, then allow 2/3marks)$ (iii) arrangement of atoms / molecules is changed B1 5 (a) (i) distance (of point on wave) from rest / equilibrium position B1 (ii) distance moved by wave energy / wavefront during one cycle of the source or minimum distance between two points with the same phase or between adjacent crests or troughs B1 (b) (i) $T = 0.60\mathrm{s}$ B1 (ii) $\lambda = 4.0\mathrm{cm}$ B1 (iii) $either\ v = \lambda IT$ or $v = f\lambda$ and $f = 1/T$ $v = 6.7\mathrm{cms^{-1}}$ C1 (c) (i) amplitude is decreasing so, it is losing power (ii) $intensity \sim (amplitude)^2$ c1 $= 3.3$ A1 (ii) $intensity \sim (amplitude)^2$ c1 $= 3.3$ C1 (iii) $either\ use\ of\ potential\ divider\ formula\ v = (0.8/2.0) \times 9$ $= 3.6\mathrm{V}$ C1 (b) (i) total\ resistance = $4/5 \times 1200$ $= 960\Omega$ C1 (ii) for parallel combination, $1/960 = 1/1600 + 1/R_T$ $R_T = 2400\Omega/2.4\mathrm{k}\Omega$ C1		(b) (i)	correct area shaded	B1	[1]	
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(ii) distance moved by wave energy / wavefront during one cycle of the source or minimum distance between two points with the same phase or between adjacent crests or troughs (b) (i) $T = 0.60 \text{s}$ (ii) $\lambda = 4.0 \text{cm}$ (iii) $either v = \lambda / T$ or $v = f\lambda$ and $f = 1/T$ $V = 6.7 \text{cms}^{-1}$ (c) (i) amplitude is decreasing so, it is losing power A1 (ii) $intensity \sim (amplitude)^2$ C1 $ratio = 2.0^2 / 1.1^2$ C1 $ratio = 3.3$ C1 (ii) $either$ use of potential divider formula or current = $9 / 2000 (4.5 \text{mA})$ C1 $V = (0.8/2.0) \times 9$ C1 $V = (9/2000) \times 800$ $= 3.6 V$ C1 (b) (i) total resistance = $4/5 \times 1200$ C1 $= 960 \Omega$ A1 (iii) for parallel combination, $1/960 = 1/1600 + 1/R_T$ $R_T = 2400 \Omega / 2.4 k\Omega$ C1		(iii)	arrangement of atoms / molecules is changed	B1	[1]	
or minimum distance between two points with the same phase or between adjacent crests or troughs (b) (i) $T = 0.60 \mathrm{s}$ (ii) $\lambda = 4.0 \mathrm{cm}$ (iii) $either v = \lambda / T$ or $v = f\lambda$ and $f = 1/T$ $v = 6.7 \mathrm{cm s}^{-1}$ (c) (i) amplitude is decreasing so, it is losing power (ii) $intensity \sim (amplitude)^2$ C1 $ratio = 2.0^2 / 1.1^2$ C1 $= 3.3$ (iii) $either \mathrm{use} \mathrm{of} \mathrm{potential} \mathrm{divider} \mathrm{formula} \mathrm{or} \mathrm{current} = 9 / 2000 (4.5 \mathrm{mA})$ (ii) $either \mathrm{use} \mathrm{of} \mathrm{potential} \mathrm{divider} \mathrm{formula} \mathrm{or} \mathrm{current} = 9 / 2000 (4.5 \mathrm{mA})$ (b) (i) $total \mathrm{resistance} = 4/5 \times 1200$ $= 3.6 \mathrm{V}$ (ii) $total \mathrm{resistance} = 4/5 \times 1200$ C1 $total resistance$	5	(a) (i)	distance (of point on wave) from rest / equilibrium position	В1	[1]	
(ii) $\lambda = 4.0 \mathrm{cm}$ B1 (iii) $either v = \lambda / T$ or $v = f\lambda$ and $f = 1/T$ C1 $v = 6.7 \mathrm{cm s}^{-1}$ M1 (c) (i) amplitude is decreasing so, it is losing power A1 (ii) $intensity \sim (amplitude)^2$ C1 $ratio = 2.0^2 / 1.1^2$ C1 $= 3.3$ A1 6 (a) (i) at $22.5 ^{\circ}\mathrm{C}$, $R_{\mathrm{T}} = 1600 \Omega$ or $1.6 \mathrm{k}\Omega$ C1 $v = (0.8/2.0) \times 9$ C1 $v = (0.8/2.0) \times 9$ C1 $v = (0.8/2.0) \times 9$ C1 $v = (9/2000) \times 800$ C1		(ii)	or minimum distance between two points with the same phase or between			
(iii) either $v = \lambda / T$ or $v = f\lambda$ and $f = 1/T$ C1 $v = 6.7 \mathrm{cm s}^{-1}$ $V = (amplitude)^2$ C1		(b) (i)	$T = 0.60 \mathrm{s}$	B1	[1]	
(c) (i) amplitude is decreasing so, it is losing power A1 (ii) $intensity \sim (amplitude)^2$ C1 ratio = $2.0^2 / 1.1^2$ C1 = 3.3 A1 (ii) at $22.5 ^{\circ}\text{C}$, $R_T = 1600\Omega$ or $1.6\text{k}\Omega$ C1 total resistance = 800Ω A1 (ii) $either$ use of potential divider formula or current = $9 / 2000 (4.5\text{mA})$ C1 $V = (0.8/2.0) \times 9$ = 3.6V A1 (b) (i) total resistance = $4/5 \times 1200$ = 3.6V A1 (ii) $either$ use of potential divider formula or current = $9 / 2000 (4.5\text{mA})$ C1 $V = (9/2000) \times 800$ = 3.6V A1		(ii)	$\lambda = 4.0 \mathrm{cm}$	B1	[1]	
(ii) $intensity \sim (amplitude)^2$ C1 ratio = $2.0^2 / 1.1^2$ C1 = 3.3 6 (a) (i) at $22.5 ^{\circ}$ C, $R_T = 1600 \Omega$ or $1.6 \mathrm{k}\Omega$ C1 total resistance = 800Ω C1 total resistance = 800Ω (ii) $either$ use of potential divider formula $V = (0.8/2.0) \times 9 = 3.6 \mathrm{V}$ C1 $V = (9/2000) \times 800 = 3.6 \mathrm{V}$ (b) (i) total resistance = $4/5 \times 1200 = 960 \Omega$ C1 $V = (9/2000) \times 800 = 3.6 \mathrm{V}$ (ii) for parallel combination, $1/960 = 1/1600 + 1/R_T$ C1 $V = (9/2000) \times 800 = 3.6 \mathrm{V}$		(iii)				
ratio = $2.0^2 / 1.1^2$ C1 = 3.3 C1 6 (a) (i) at 22.5 °C, $R_T = 1600 \Omega$ or $1.6 k\Omega$ C1 total resistance = 800Ω A1 (ii) either use of potential divider formula or current = $9 / 2000 (4.5 \text{ mA})$ C1 $V = (0.8/2.0) \times 9$ $V = (9/2000) \times 800$ C1 = 3.6 V A1 (b) (i) total resistance = $4/5 \times 1200$ C1 = 960Ω C1 (ii) for parallel combination, $1/960 = 1/1600 + 1/R_T$ C1		(c) (i)	•			
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$V = (0.8/2.0) \times 9$ $V = (9/2000) \times 800$ = 3.6 V A1 (b) (i) total resistance = 4/5 × 1200 C1 = 960 Ω A1 (ii) for parallel combination, 1/960 = 1/1600 + 1/ R_T $R_T = 2400 \Omega / 2.4 k\Omega$ C1	6					
$= 960 \Omega$ A1 (ii) for parallel combination, $1/960 = 1/1600 + 1/R_T$ $R_T = 2400 \Omega / 2.4 k\Omega$ C1		(ii)	$V = (0.8/2.0) \times 9$ $V = (9/2000) \times 800$,		
$R_{\rm T} = 2400 \Omega / 2.4 k\Omega$		(b) (i)				
		` ,	$R_{\rm T} = 2400 \Omega / 2.4 \mathrm{k}\Omega$			

Mark Scheme: Teachers' version

Syllabus

Paper

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	(c)	Ū	non-	small part of scale used / small sensitivity linear sensible suggestions, 1 each, max 2)		B1 B1	[2]
7	(a)	(i)		\underline{t} α -particles were deviated through small angles w 1 mark for 'straight through' / undeviated)		B2	[2]
		(ii)		Il fraction of α -particles deviated through large angles ater than 90° (allow rebound back)		M1 A1	[2]
	(b)	e.g.	β-pa β-pa	articles have a range of energies articles deviated by (orbital) electrons article has (very) small mass artwo sensible suggestions, 1 each, max 2)		B2	[2]
		Do	not a	llow $β$ -particles have negative charge or $β$ -particles have	ve high speed		

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