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

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1	(a)	(i)	scalar quantity has magnitude (allow size)	B1	
			vector quantity has magnitude and direction	B1	[2]
		(ii)	1. temperature: scalar	B1	[1]
			2. acceleration: vector	B1	[1]
			3. resistance: scalar	B1	[1]
	(b)	*either*	triangle / parallelogram with correct shape	C1	
			tension = 14 .3 N (*allow ± 0.5 N*)	A2	[3]
			(*if > ±0.5 N but ≤ ±1 N, allow 1 mark*)		
		or	R = 25 cos 35°	(C1)	
			T = R tan 35°	(C1)	
			T = 14.3 N	(A1)	
		or	T = 25 sin 35°	(C2)	
			T = 14.3 N	(A1)	
		or	R and T resolved vertically and horizontally	(C2)	
			leading to T = 14.3 N	(A1)	
2	(a)	(i)	$V_H = 12.4 \cos 36°$ (= 10.0 m s^{-1})	C1	
			distance = 10.0 × 0.17		
			= 1.7 m	A1	[2]
		(ii)	$V_V = 12.4 \sin 36°$ (= 7.29 m s^{-1})	C1	
			$h = 7.29 \times 0.17 - ½ \times 9.81 \times 0.17^2$	C1	
			= 1.1 m	A1	[3]
	(b)		smooth curve with ball hitting wall below original	B1	
			smooth curve showing rebound to ground with correct reflection at wall	B1	[2]
3	(a)		point at which (whole) weight (of body) (allow mass for weight)	M1	
			appears / seems to act ... (for mass need 'appears to be concentrated')	A1	[2]
	(b)	(i)	point C shown at centre of rectangle ± 5 mm	B1	[1]
		(ii)	arrow vertically downwards, from C with arrow starting from the same margin of error as in **(b)(i)**	B1	[1]
	(c)	(i)	reaction / upwards / supporting / normal reaction force	M1	
			friction	M1	
			force(s) at the rod	A1	[3]
		(ii)	comes to rest with (line of action of) weight acting through rod		
			allow C vertically below the rod	B1	
			so that weight does not have a moment about the pivot / rod	B1	[2]

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4	**(a)**	energy = average force × extension	B1	
		= ½ × F × x	B1	
		(Hooke's law) extension proportional to (applied) force	B1	
		hence $F = kx$	B1	
		so $E = ½kx^2$	A0	[4]
	(b) (i)	correct area shaded	B1	[1]
	(ii)	1.0 cm^2 represents 1.0 mJ or correct units used in calculation	C1	
		E_S = 6.4 ± 0.2 mJ	A2	[3]
		(*for answer > ±0.2 mJ but ≤ ±0.4 mJ, then allow 2/3 marks*)		
	(iii)	arrangement of atoms / molecules is changed	B1	[1]
5	**(a) (i)**	distance (of point on wave) from rest / equilibrium position	B1	[1]
	(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	[1]
	(b) (i)	T = 0.60 s	B1	[1]
	(ii)	λ = 4.0 cm	B1	[1]
	(iii)	*either* $v = \lambda/T$ *or* $v = f\lambda$ <u>and</u> $f = 1/T$	C1	
		v = 6.7 cm s^{-1}	A1	[2]
	(c) (i)	amplitude is decreasing	M1	
		so, it is losing power	A1	[2]
	(ii)	*intensity* ~ (*amplitude*)^2	C1	
		ratio = $2.0^2 / 1.1^2$	C1	
		= 3.3	A1	[3]
6	**(a) (i)**	at 22.5 °C, R_T = 1600 Ω or 1.6 kΩ	C1	
		total resistance = 800 Ω	A1	[2]
	(ii)	*either* use of potential divider formula *or* current = 9 / 2000 (4.5 mA)	C1	
		V = (0.8/2.0) × 9 / V = (9/2000) × 800		
		= 3.6 V / = 3.6 V	A1	[2]
	(b) (i)	total resistance = 4/5 × 1200	C1	
		= 960 Ω	A1	[2]
	(ii)	for parallel combination, 1/960 = 1/1600 + 1/R_T		
		R_T = 2400 Ω / 2.4 kΩ	C1	
		temperature = 11 °C	A1	[2]

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	(c)		e.g. only small part of scale used / small sensitivity	B1	
			non-linear	B1	[2]
			(*any two sensible suggestions, 1 each, max 2*)		
7	**(a)**	**(i)**	<u>most</u> α-particles were deviated through small angles	B2	[2]
			(*allow 1 mark for 'straight through' / undeviated*)		
		(ii)	small fraction of α-particles deviated through large angles	M1	
			greater than 90° (allow rebound back)	A1	[2]
	(b)		e.g. β-particles have a range of energies		
			β-particles deviated by (orbital) electrons		
			β-particle has (very) small mass		
			(*any two sensible suggestions, 1 each, max 2*)	B2	[2]
			Do not allow β-particles have negative charge or β-particles have high speed		

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