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)**		<u>point</u> 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 <u>weight</u> 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* $v = f\lambda$ and $f = 1/T$ — 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)** most 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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