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.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

- CIE will not enter into discussions or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the October/November 2010 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

UNIVERSITY of CAMBRIDGE
International Examinations

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 × 0.17 – ½ × 9.81 × 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]

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	
			$E_S = 6.4 \pm 0.2$ 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)	$\lambda = 4.0$ 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	
			$V = (0.8/2.0) \times 9$ / $V = (9/2000) \times 800$		
			= 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]

	(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