

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	Mark Scheme: Teachers' version	Syllabus	Paper
	GCE A LEVEL – October/November 2010	9702	22
1	(a) (i) scalar quantity has magnitude (allow size) vector quantity has magnitude and direction		B1 B1 [2]
	(ii) 1. temperature: scalar 2. acceleration: vector 3. resistance: scalar		B1 [1] B1 [1] B1 [1]
	(b) <i>either</i> triangle / parallelogram with correct shape tension = 14.3 N (allow ± 0.5 N)		C1 A2 [3]
	(if $> \pm 0.5$ N but $\leq \pm 1$ N, allow 1 mark)		
	or $R = 25 \cos 35^\circ$ $T = R \tan 35^\circ$ $T = 14.3$ N		(C1) (C1) (A1)
	or $T = 25 \sin 35^\circ$ $T = 14.3$ N		(C2) (A1)
	or R and T resolved vertically and horizontally leading to $T = 14.3$ N		(C2) (A1)
2	(a) (i) $V_H = 12.4 \cos 36^\circ (= 10.0 \text{ m s}^{-1})$ distance = 10.0×0.17 = 1.7 m		C1 A1 [2]
	(ii) $V_V = 12.4 \sin 36^\circ (= 7.29 \text{ m s}^{-1})$ $h = 7.29 \times 0.17 - \frac{1}{2} \times 9.81 \times 0.17^2$ = 1.1 m		C1 C1 A1 [3]
	(b) smooth curve with ball hitting wall below original smooth curve showing rebound to ground with correct reflection at wall		B1 B1 [2]
3	(a) <u>point</u> at which (whole) weight (of body) (allow mass for weight) appears / seems to act ... (for mass need 'appears to be concentrated')		M1 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 friction force(s) at the rod		M1 M1 A1 [3]
	(ii) comes to rest with (line of action of) weight acting through rod allow C vertically below the rod so that <u>weight</u> does not have a moment about the pivot / rod		B1 B1 [2]

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- 4 (a) energy = average force \times extension
 $= \frac{1}{2} \times F \times x$
(Hooke's law) extension proportional to (applied) force
hence $F = kx$
so $E = \frac{1}{2}kx^2$ B1
B1
B1
B1
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
 $E_s = 6.4 \pm 0.2 \text{ mJ}$ A2 [3]
(for answer $> \pm 0.2 \text{ mJ}$ but $\leq \pm 0.4 \text{ mJ}$, then allow 2/3 marks)
- (iii) arrangement of atoms / molecules is changed B1 [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) $T = 0.60 \text{ s}$ B1 [1]
- (ii) $\lambda = 4.0 \text{ cm}$ B1 [1]
- (iii) either $v = \lambda/T$ or $v = f\lambda$ and $f = 1/T$ C1
 $v = 6.7 \text{ cm s}^{-1}$ A1 [2]
- (c) (i) amplitude is decreasing
so, it is losing power M1
A1 [2]
- (ii) intensity $\sim (\text{amplitude})^2$ C1
ratio = $2.0^2 / 1.1^2$ C1
= 3.3 A1 [3]
- 6 (a) (i) at $22.5 \text{ }^\circ\text{C}$, $R_T = 1600 \Omega$ or $1.6 \text{ k}\Omega$ C1
total resistance = 800Ω 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 = $4/5 \times 1200$ C1
= 960Ω A1 [2]
- (ii) for parallel combination, $1/960 = 1/1600 + 1/R_T$
 $R_T = 2400 \Omega$ / $2.4 \text{ k}\Omega$ C1
temperature = $11 \text{ }^\circ\text{C}$ A1 [2]

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- (c) e.g. only small part of scale used / small sensitivity
non-linear
(any two sensible suggestions, 1 each, max 2) B1
B1 [2]
- 7 (a) (i) most α -particles were deviated through small angles
(allow 1 mark for 'straight through' / undeviated) B2 [2]
- (ii) small fraction of α -particles deviated through large angles
greater than 90° (allow rebound back) M1
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