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)
$T = 14.3\,\text{N}$ (A1)
or $T = 25 \sin 35°$ (C2)
$T = 14.3\,\text{N}$ (A1)
or R and T resolved vertically and horizontally (C2)
leading to $T = 14.3\,\text{N}$ (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]

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]

(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