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

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) <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]

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 $E = \frac{1}{2}kx^2$ 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, $R_T = 1600\,\Omega$ 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
             $R_T = 2400\,\Omega$ / 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)** <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