UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2012 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)** $\frac{V}{t} = \frac{\pi P r^4}{8 C l}$

$C = [\pi \times 2.5 \times 10^3 \times (0.75 \times 10^{-3})^4] / (8 \times 1.2 \times 10^{-6} \times 0.25)$ C1

$= 1.04 \times 10^{-3}$ N s m^{-2} A1 [2]

(b) $4 \times \%r$ C1

$\%C = \%P + 4 \times \%r + \%V/t + \%l$

$= 2\% + 5.3\% + 0.83\% + 0.4\%$ (= 8.6%) A1

$\Delta C = \pm 0.089 \times 10^{-3}$ N s m^{-2} A1 [3]

(c) $C = (1.04 \pm 0.09) \times 10^{-3}$ N s m^{-2} A1 [1]

2 **(a)** **(i)** $v^2 = u^2 + 2as$

$= (8.4)^2 + 2 \times 9.81 \times 5$ C1

$= 12.99$ m s^{-1} *(allow 13 to 2 s.f. but not 12.9)* A1 [2]

(ii) $t = (v - u) / a$ or $s = ut + ½at^2$

$= (12.99 - 8.4) / 9.81$ or $5 = 8.4t + ½ \times 9.81t^2$ M1

$t = 0.468$ s A0 [1]

(b) reasonable shape M1

suitable scale A1

correctly plotted 1st and last points at (0,8.4) and (0.88 – 0.96,0)

with non-vertical line at 0.47 s A1 [3]

(c) **(i)** **1.** kinetic energy at end is zero so $\Delta KE = ½ mv^2$ or $\Delta KE = ½ mu^2 - ½ mv^2$ C1

$= ½ \times 0.05 \times (8.4)^2$

$= (-) 1.8$ J A1 [2]

2. final maximum height $= (4.2)^2 / (2 \times 9.8) = (0.9$ (m)) change in PE $= mgh_2 - mgh_1$ C1

$= 0.05 \times 9.8 \times (0.9 - 5)$ C1

$= (-) 2.0$ J A1 [3]

(ii) change is – 3.8 (J) B1

energy lost to ground (on impact) / energy of deformation of the ball / thermal energy in ball B1 [2]

3 **(a)** A body continues at rest or constant velocity unless acted on by a resultant (external) force B1 [1]

(b) **(i)** constant velocity/zero acceleration and therefore no resultant force M1

no resultant force (and no resultant torque) hence in equilibrium A1 [2]

(ii) component of weight $= 450 \times 9.81 \times \sin 12°$ (= *917.8*) C1

tension $= 650 + 450g \sin 12° = (650 + 917.8)$ C1

$= 1600$ (1570) N A1 [3]

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(iii) work done against frictional force or friction between log and slope M1
output power greater than the gain in PE / s A1 [2]

4 (a) total resistance = 20 (kΩ) C1
current = 12 / 20 (mA) or potential divider formula C1
p.d. = [12 / 20] × 12 = 7.2 V A1 [3]

(b) parallel resistance = 3 (kΩ) C1
total resistance 8 + 3 = 11 (kΩ) C1
current = 12 / 11 × 10^3 = 1.09 × 10^{-3} or 1.1 × 10^{-3} A A1 [3]

(c) (i) LDR resistance decreases M1
total resistance (of circuit) is less hence current increases A1 [2]

(ii) resistance across XY is less M1
less proportion of 12 V across XY hence p.d. is less A1 [2]

5 (a) E = stress / strain B1 [1]

(b) (i) 1. diameter / cross sectional area / radius
2. original length B1 [1]

(ii) measure original length with a metre ruler / tape B1
measure the diameter with micrometer (screw gauge) B1 [2]
allow digital vernier calipers

(iii) energy = ½ Fe or area under graph or ½ kx^2 C1
= ½ × 0.25 × 10^{-3} × 3 = 3.8 × 10^{-4} J A1 [2]

(c) straight line through origin below original line M1
line through (0.25, 1.5) A1 [2]

6 (a) two waves travelling (along the same line) in opposite directions overlap/meet M1
same frequency / wavelength A1
resultant displacement is the sum of displacements of each wave /
produces nodes and antinodes B1 [3]

(b) apparatus: source of sound + detector + reflection system B1
adjustment to apparatus to set up standing waves – how recognised B1
measurements made to obtain wavelength B1 [3]

(c) (i) at least two nodes and two antinodes A1 [1]

(ii) node to node = λ / 2 = 34 cm (allow 33 to 35 cm) C1
$c = f\lambda$ C1
f = 340 / 0.68 = 500 (490 to 520) Hz A1 [3]

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7 **(a)** W = 1 and X = 0 A1 [1]
Y = 2 A1 [1]
Z = 55 A1 [1]

(b) explanation in terms of mass – energy conservation B1
energy released as gamma or photons or kinetic energy of products or em radiation B1 [2]

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