

**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

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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- 1 (a)  $\frac{V}{t} = \frac{\pi P r^4}{8 C l}$   
 $C = [\pi \times 2.5 \times 10^3 \times (0.75 \times 10^{-3})^4] / (8 \times 1.2 \times 10^{-6} \times 0.25)$   
 $= 1.04 \times 10^{-3} \text{ N s m}^{-2}$  C1  
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  
 $\Delta C = \pm 0.089 \times 10^{-3} \text{ N s m}^{-2}$  A1 [3]
- (c)  $C = (1.04 \pm 0.09) \times 10^{-3} \text{ N s m}^{-2}$  A1 [1]
- 2 (a) (i)  $v^2 = u^2 + 2as$   
 $= (8.4)^2 + 2 \times 9.81 \times 5$  C1  
 $= 12.99 \text{ m s}^{-1}$  (allow 13 to 2 s.f. but not 12.9) A1 [2]
- (ii)  $t = (v - u) / a$  or  $s = ut + \frac{1}{2}at^2$   
 $= (12.99 - 8.4) / 9.81$  or  $5 = 8.4t + \frac{1}{2} \times 9.81t^2$  M1  
 $t = 0.468 \text{ s}$  A0 [1]
- (b) reasonable shape M1  
suitable scale A1  
correctly plotted 1<sup>st</sup> 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  $\Delta KE = \frac{1}{2}mv^2$  or  $\Delta KE = \frac{1}{2}mu^2 - \frac{1}{2}mv^2$  C1  
 $= \frac{1}{2} \times 0.05 \times (8.4)^2$   
 $= (-) 1.8 \text{ J}$  A1 [2]
2. final maximum height  $= (4.2)^2 / (2 \times 9.8) = (0.9 \text{ (m)})$   
change in PE  $= mgh_2 - mgh_1$  C1  
 $= 0.05 \times 9.8 \times (0.9 - 5)$  C1  
 $= (-) 2.0 \text{ J}$  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) 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  $= 450 \times 9.81 \times \sin 12^\circ (= 917.8)$  C1  
tension  $= 650 + 450g \sin 12^\circ = (650 + 917.8)$  C1  
 $= 1600 (1570) \text{ N}$  A1 [3]

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	(iii) work done against frictional force or friction between log and slope output power greater than the gain in PE / s	M1 A1	[2]
4	(a) total resistance = 20 (k $\Omega$ ) current = 12 / 20 (mA) or potential divider formula p.d. = [12 / 20] $\times$ 12 = 7.2V	C1 C1 A1	[3]
	(b) parallel resistance = 3 (k $\Omega$ ) total resistance 8 + 3 = 11 (k $\Omega$ ) current = 12 / 11 $\times$ 10 <sup>3</sup> = 1.09 $\times$ 10 <sup>-3</sup> or 1.1 $\times$ 10 <sup>-3</sup> A	C1 C1 A1	[3]
	(c) (i) LDR resistance decreases total resistance (of circuit) is less hence current increases	M1 A1	[2]
	(ii) resistance across XY is less less proportion of 12V across XY hence p.d. is less	M1 A1	[2]
5	(a) $E = \text{stress} / \text{strain}$	B1	[1]
	(b) (i) 1. diameter / cross sectional area / radius 2. original length	B1	[1]
	(ii) measure original length with a <u>metre</u> ruler / tape measure the <u>diameter</u> with micrometer (screw gauge) <i>allow digital vernier calipers</i>	B1 B1	[2]
	(iii) energy = $\frac{1}{2} Fe$ or area under graph or $\frac{1}{2} kx^2$ $= \frac{1}{2} \times 0.25 \times 10^{-3} \times 3 = 3.8 \times 10^{-4} \text{ J}$	C1 A1	[2]
	(c) straight line through origin below original line line through (0.25, 1.5)	M1 A1	[2]
6	(a) two waves travelling (along the same line) in opposite directions overlap/meet same frequency / wavelength resultant displacement is the sum of displacements of each wave / produces nodes and antinodes	M1 A1 B1	[3]
	(b) apparatus: source of sound + detector + reflection system adjustment to apparatus to set up standing waves – how recognised measurements made to obtain wavelength	B1 B1 B1	[3]
	(c) (i) at least two nodes and two antinodes	A1	[1]
	(ii) node to node = $\lambda / 2 = 34 \text{ cm}$ (allow 33 to 35 cm) $c = f\lambda$ $f = 340 / 0.68 = 500$ (490 to 520) Hz	C1 C1 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]