

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**

**9702/21**

Paper 2 (AS Structured Questions), maximum raw mark 60

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- 1 (a) length, current, temperature, amount of substance, (luminous intensity)  
any three, 1 each B3 [3]
- (b) (i)  $F: \text{kg m s}^{-2}$  B1  
 $\rho: \text{kg m}^{-3}$  B1  
 $v: \text{m s}^{-1}$  B1 [3]
- (ii) some working e.g.  $\text{kg m s}^{-2} = \text{m}^2 \text{kg m}^{-3} (\text{m s}^{-1})^k$  M1  
hence  $k = 2$  A1 [2]
- 2 (a) (i) horizontal speed constant at  $8.2 \text{ m s}^{-1}$  C1  
vertical component of speed =  $8.2 \tan 60^\circ$  M1  
=  $14.2 \text{ m s}^{-1}$  A0 [2]
- (ii)  $14.2^2 = 2 \times 9.8 \times h$  (using  $g = 10$  then  $-1$ ) C1  
vertical distance =  $10.3 \text{ m}$  A1 [2]
- (iii) time of descent =  $14.2 / 9.8 = 1.45 \text{ s}$  C1  
 $x = 1.45 \times 8.2$   
=  $11.9 \text{ m}$  A1 [2]
- (b) (i) smooth path curved and above given path M1  
hits ground at more acute angle A1 [2]
- (ii) smooth path curved and below given path M1  
hits ground at steeper angle A1 [2]
- 3 (a) force = rate of change of momentum (allow symbols if defined) B1 [1]
- (b) (i)  $\Delta p = 140 \times 10^{-3} \times (5.5 + 4.0)$  C1  
=  $1.33 \text{ kg m s}^{-1}$  A1 [2]
- (ii) force =  $1.33 / 0.04$  M1  
=  $33.3 \text{ N}$  A0 [1]
- (c) (i) taking moments about B C1  
 $(33 \times 75) + (0.45 \times g \times 25) = F_A \times 20$  C1  
 $F_A = 129 \text{ N}$  A1 [3]
- (ii)  $F_B = 33 + 129 + 0.45g$  C1  
=  $166 \text{ N}$  A1 [2]

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- 4 (a) (i)  $F/A$  B1 [1]
- (ii)  $\Delta L/L$  B1 [1]
- (iii) allow  $FL/A\Delta L$  B1 [1]
- (iv) allow  $\rho L/A$  or  $\rho(L + \Delta L)/A$  B1 [1]
- (b) (i)  $\Delta L = FL/EA$   
 $= (30 \times 2.6) / (7.0 \times 10^{10} \times 3.8 \times 10^{-7})$   
 $= 2.93 \times 10^{-3} \text{ m} = 2.93 \text{ mm}$  M1  
A0 [1]
- (ii)  $\Delta R = \rho\Delta L/A$   
 $= (2.6 \times 10^{-8} \times 2.93 \times 10^{-3}) / (3.8 \times 10^{-7})$   
 $= 2.0 \times 10^{-4} \Omega$  C1  
A1 [2]
- (c) change in resistance is (very) small  
so method is not appropriate M1  
A1 [2]
- 5 (a) when a wave passes through a slit / by an edge  
the wave spreads out / changes direction M1  
A1 [2]
- (b) diagram: wavelength unchanged M1  
wavefront flat at centre, curving into geometrical shadow A1 [2]
- (c)  $d \sin \theta = n\lambda$   
for  $\theta = 90^\circ$   
 $1 / (650 \times 10^3) = n \times 590 \times 10^{-9}$   
 $n = 2.6$   
number of orders is 2 C1  
M1  
A1 [3]
- (d) intensity / brightness decreases (as order increases) B1 [1]
- 6 (a) (i) either  $P = V^2/R$  or  $P = VI$  and  $V = IR$   
 $R = 4.0 \Omega$  C1  
A1 [2]
- (ii) sketch vertical axis labelled appropriately B1  
(straight) line from origin then curved in correct direction B1  
line passes through 12 V, 3.0 A B1 [3]
- (b) (i) 2.0 kW A1 [1]
- (ii) 0.5 kW A1 [1]
- (iii) total resistance =  $3R/2$   
power = 0.67 kW C1  
A1 [2]

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- 7 (a) *either* different forms of same element  
*or* nuclei have same number of protons  
different numbers of neutrons (in the nucleus) M1  
A1 [2]
- (b) (i) proton number conserved B1  
nucleon number conserved B1  
mass-energy conserved B1 [3]
- (ii) 1.  $Z = 36$  A1 [1]  
2.  $x = 3$  A1 [1]