

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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	GCE AS/A LEVEL – October/November 2010	9702	21

- 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 m s^{-1} C1
vertical component of speed = $8.2 \tan 60^\circ$ M1
= 14.2 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 m A1 [2]
- (iii) time of descent = $14.2 / 9.8 = 1.45 \text{ s}$ C1
 $x = 1.45 \times 8.2$
= 11.9 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 kg m s^{-1} A1 [2]
- (ii) force = $1.33 / 0.04$ M1
= 33.3 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 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]