**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)** $F$: kg m s$^{-2}$ B1
$\rho$: kg m$^{-3}$ B1
$v$: m s$^{-1}$ B1 [3]

**(ii)** some working e.g. kg m s$^{-2}$ = m$^2$ kg m$^{-3}$ (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° 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 s C1
$x$ = 1.45 × 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)** $\Delta\rho$ = 140 × 10$^{-3}$ × (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 × 75) + (0.45 × $g$ × 25) = $F_A$ × 20 C1
$F_A$ = 129 N A1 [3]

**(ii)** $F_B$ = 33 + 129 + 0.45$g$ 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)** $\Delta L = FL / EA$
$= (30 \times 2.6) / (7.0 \times 10^{10} \times 3.8 \times 10^{-7})$ M1
$= 2.93 \times 10^{-3}$ m = 2.93 mm A0 [1]

**(ii)** $\Delta R = \rho \Delta L / A$ C1
$= (2.6 \times 10^{-8} \times 2.93 \times 10^{-3}) / (3.8 \times 10^{-7})$
$= 2.0 \times 10^{-4}\ \Omega$ A1 [2]

**(c)** change in resistance is (very) small M1
so method is not appropriate A1 [2]

**5 (a)** when a wave passes through a slit / by an edge M1
the wave spreads out / changes direction A1 [2]

**(b)** diagram: wavelength unchanged M1
wavefront flat at centre, curving into geometrical shadow A1 [2]

**(c)** $d \sin \theta = n\lambda$ C1
for $\theta = 90°$
$1 / (650 \times 10^3) = n \times 590 \times 10^{-9}$ M1
$n = 2.6$
number of orders is 2 A1 [3]

**(d)** intensity / brightness decreases (as order increases) B1 [1]

**6 (a) (i)** *either* $P = V^2 / R$ *or* $P = VI$ and $V = IR$ C1
$R = 4.0\ \Omega$ 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 = $3R / 2$ C1
power = 0.67 kW A1 [2]

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**7** **(a)** *either* different forms of same element
*or* nuclei have same number of protons M1
different numbers of neutrons (in the nucleus) 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]

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