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* B

(b) **(i)** F: kg m s^{-2} B1
ρ: 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 + 0.45g C1
= 166 N A1 [2]

4 **(a)** **(i)** F / A

(ii) $\Delta L / L$ B1

(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]

7 **(a)** *either* different forms of same element
or nuclei have same number of protons
different numbers of neutrons (in the nucleus) — A1

(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]