

**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

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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	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]