## 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

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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- 1 (a) length, current, temperature, amount of substance, (luminous intensity) any three, 1 each
- B3 [3]

[3]

- (b) (i)  $F: \text{kg m s}^{-2}$  B1  $\rho: \text{kg m}^{-3}$  B1  $v: \text{m s}^{-1}$ 
  - (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  $8.2 \text{ m s}^{-1}$  C1 vertical component of speed =  $8.2 \text{ tan } 60^{\circ}$  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 m
  - (iii) time of descent = 14.2 / 9.8 = 1.45 s C1  $x = 1.45 \times 8.2$ = 11.9 m A1 [2]
  - (b) (i) smooth path curved and above given path hits ground at more acute angle M1 [2]
    - (ii) smooth path curved and below given path
      hits ground at steeper angle

      M1
      A1 [2]
- 3 (a) force = rate of change of momentum (allow symbols if defined) B1 [1]
  - (b) (i)  $\Delta \rho = 140 \times 10^{-3} \times (5.5 + 4.0)$  C1 = 1.33 kg m s<sup>-1</sup> A1 [2]
    - (ii) force = 1.33 / 0.04 M1 = 33.3 N A0 [1]
  - (c) (i) taking moments about B  $(33 \times 75) + (0.45 \times g \times 25) = F_A \times 20$  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 <i>FL / A</i> Δ <i>L</i>	B1	[1]
	(iv)	allow $\rho L/A$ or $\rho(L + \Delta L)/A$	B1	[1]
	(b) (i)	$\Delta L = FL / EA$ = $(30 \times 2.6) / (7.0 \times 10^{10} \times 3.8 \times 10^{-7})$ = $2.93 \times 10^{-3}$ m = $2.93$ mm	M1 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]
	` '	nge in resistance is (very) small nethod is not appropriate	M1 A1	[2]
5		n a wave passes through a slit / by an edge wave spreads out / changes direction	M1 A1	[2]
	(b) diag	ram: wavelength unchanged wavefront flat at centre, curving into geometrical shadow	M1 A1	[2]
	( <b>c</b> ) <i>d</i> sin		C1	
		for $\theta = 90^{\circ}$ 1 / (650 × 10 <sup>3</sup> ) = $n$ × 590 × 10 <sup>-9</sup>		
	n=2		A1	[3]
				[-]
	(d) inter	nsity / 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]
		sketch vertical axis labelled appropriately (straight) line from origin then curved in correct direction line passes through 12 V, 3.0 A	B1 B1 B1	[3]
	(b) (i)	2.0 kW	A1	[1]
	(ii)	0.5 kW	A1	[1]
	, ,	total resistance = 3 <i>R</i> / 2 power = 0.67 kW	C1 A1	[2]

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7	(a)	either or differe	different forms of same element nuclei have same number of protons nt numbers of neutrons (in the nucleus)		M1 A1	[2]
	(b)	nı	oton number conserved icleon number conserved ass-energy conserved		B1 B1 B1	[3]
		` '	Z = 36 $x = 3$		A1 A1	[1] [1]