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

9702/23 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)** allow 0.05 mm → 0.15 mm	B1	[1]
	(b) allow 0.25 s → 0.5 s	B1	[1]
	(c) allow 8 N → 12 N	B1	[1]
	ignore number of significant figures		
2	crystalline: atoms / ions / particles in a regular arrangement / lattice		
	long range order / orderly pattern	B1	
	(lattice) repeats itself (1)		
	polymer: long chain molecules / chains of monomers	B1	
	some cross-linking between chains / tangled chains (1)		
	amorphous: disordered arrangement of molecules / atoms / particles	B1	
	any ordering is short-range (1)		
	(*three 'B' marks plus any other 2 marks*)	B2	[5]
3	connect microphone / (terminals of) loudspeaker to Y-plates of c.r.o.	B1	
	adjust c.r.o. to produce steady wave of 1 (or 2) cycles / wavelengths on screen	B1	
	measure length of cycle / wavelength λ and note time-base *b*	M1	
	frequency = $1 / \lambda b$	A1	[4]
	(*assume b is measured as s cm^{-1}, unless otherwise stated*)		
	(if statement is 'measure *T*, f = 1/*T*' then last two marks are lost)		
4	**(a)** acceptable straight line drawn (touching every point)	B1	[1]
	(b) the distance fallen is not *d*	C1	
	d is the distance fallen plus the diameter of the ball	A1	[2]
	('d is not measured to the bottom of the ball' scores 2/2)		
	(c) (i) diameter: allow 1.5 ± 0.5 cm (accept one SF)	A1	[1]
	no ecf from **(a)**		
	(ii) gradient = 4.76, ± 0.1 with evidence that origin has not been used	C1	
	gradient = *g* / 2	C1	
	g = 9.5 m s^{-2}	A1	[3]

5 **(a)** **(i)** Fig. 5.2 B1 [1]

(ii) Fig. 5.3 B1 [1]

(b) kinetic energy increases from zero then decreases to zero B1 [1]

(c) **(i)** $\Delta E_P = mg\Delta h \,/\, mgh$ C1
$= 94 \times 10^{-3} \times 9.8 \times 2.6 \times 10^{-2}$ using g = 10 then –1
$= 0.024\,\text{J}$ A1 [2]

(ii) *either* $0.024 = \tfrac{1}{2} k \times (2.6 \times 10^{-2})^2$ *or* $\tfrac{1}{2}kd^2 = \tfrac{1}{2}k \times (2.6 \times 10^{-2})^2 - \tfrac{1}{2}kd^2$ C1
$0.012 = \tfrac{1}{2}k \times d^2$ $kd^2 = \tfrac{1}{2}k \times (2.6 \times 10^{-2})^2$ C1
$d = 0.018\,\text{m}$ $d = 0.018\,\text{m}$
$= 1.8\,\text{cm}$ $= 1.8\,\text{cm}$ A1 [3]

6 **(a)** when two (or more) waves meet (at a point) B1
(resultant) displacement is (vector) sum of individual displacements B1 [2]

(b) **(i)** $\lambda = ax / D$ (if no formula given and substitution is incorrect then 0/3) C1
$590 \times 10^{-9} = (1.4 \times 10^{-3} \times x) / 2.6$ C1
$x = 1.1\,\text{mm}$ A1 [3]

(ii) **1.** 180° (*allow π if rad stated*) A1 [1]

2. at maximum, amplitude is 3.4 units and at minimum, 0.6 units C1
intensity ~ *amplitude*^{2} allow $I \sim a^2$ C1
ratio = $3.4^2 / 0.6^2$
= 32 A1 [3]

7 **(a)** **(i)** path: reasonable curve upwards between plates B1
straight and at a tangent to the curve beyond the plates B1 [2]

(ii) **1.** (F =) $E.g$ B1 [1]

2. (t =) L / v B1 [1]

(b) **(i)** total momentum of a system remains constant **or** total momentum of a system before a collision equals total momentum after collision M1
provided no external force acts on the system A1 [2]
(do not accept 'conserved' but otherwise correct statement gets 1/2)

(ii) (Δp =) EqL / v allow ecf from **(a)(ii)** B1 [1]

(iii) *either* charged particle is not an isolated system M1
so law does not apply A1 [2]
or system is particle and 'plates' (M1)
equal and opposite Δp on plates / so law applies (A1)

8	**(a)**	**(i)**	*either* $P = V^2 / R$ *or* I = 1200 / 230 or 5.22	C1	
			R = (230 × 230) / 1200		
			$R = 230^2 / 1200$ or R = 230 / 5.22	M1	
			= 44.1 Ω = 44.1 Ω	A0	[2]
		(ii)	$R = \rho L / A$	C1	
			$= (1.7 \times 10^{-8} \times 9.2 \times 2) / (\pi \times \{0.45 \times 10^{-3}\}^2)$	M1	
			= 0.492 Ω	A0	[2]
	(b)		current = 230 /44.6	C1	
			power = $(230 / 44.6)^2 \times 44.1$	C1	
			= 1170 W	A1	[3]
			(*allow full credit for solution based on potential divider*)		
	(c)		e.g. less power dissipated in the heater / smaller p.d. across heater /		
			more power loss in cable / current lower	B1	
			cable becomes heated / melts	B1	[2]
			(*any two sensible suggestions, 1 each, max 2*)		
9	**(a)**		<u>nucleus</u> emits α-particles or β-particles and/or γ-radiation	B1	
			to form a different / more stable nucleus	B1	[2]
	(b)	**(i)**	fluctuations in count rate (not 'count rate is not constant')	B1	[1]
		(ii)	no effect	B1	[1]
		(iii)	if the source is an α-emitter	B1	
			either α-particles stopped within source (and gain electrons)		
			or α-particles are helium <u>nuclei</u>	B1	[2]
			allow 1/2 for 'parent nucleus gives off radiation to form daughter nucleus'		