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

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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* $0.024 = ½\,k \times (2.6 \times 10^{-2})^2$ C1
$0.012 = ½k \times d^2$ C1
$d = 0.018\,\text{m}$
$= 1.8\,\text{cm}$ A1 [3]

or $½\,kd^2 = ½k \times (2.6 \times 10^{-2})^2 - ½kd^2$ C1
$kd^2 = ½k \times (2.6 \times 10^{-2})^2$ C1
$d = 0.018\,\text{m}$
$= 1.8\,\text{cm}$ 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) ($\Delta p =$) 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
$R = (230 \times 230) / 1200$
$R = 230^2 / 1200$ or $R = 230 / 5.22$ M1
$= 44.1\,\Omega$ $= 44.1\,\Omega$ 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
$= 0.492\,\Omega$ A0 [2]

(b) current $= 230 / 44.6$ C1
power $= (230 / 44.6)^2 \times 44.1$ C1
$= 1170\,\text{W}$ 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'