**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 $\lambda$ 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] |

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|---|---|---|---|---|---|
| **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 | | |
| | | | $= 0.024$ J | A1 | [2] |
| | | **(ii)** | *either* $0.024 = ½\,k \times (2.6 \times 10^{-2})^2$ *or* $½\,kd^2 = ½k \times (2.6 \times 10^{-2})^2 - ½kd^2$ | C1 | |
| | | | $0.012 = ½k \times d^2$ $\quad kd^2 = ½k \times (2.6 \times 10^{-2})^2$ | C1 | |
| | | | $d = 0.018$ m $\quad d = 0.018$ m | | |
| | | | $= 1.8$ cm $\quad = 1.8$ 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 | |
| | | | $x = 1.1$ mm | A1 | [3] |
| | | **(ii)** | **1.** 180° (*allow* $\pi$ *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 $\Delta p$ on plates / so law applies | (A1) | |

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| **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 $\alpha$-particles or $\beta$-particles and/or $\gamma$-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 $\alpha$-emitter | B1 | |
| | | | *either* $\alpha$-particles stopped within source (and gain electrons) | | |
| | | | *or* $\alpha$-particles are helium <u>nuclei</u> | B1 | [2] |
| | | | allow 1/2 for 'parent nucleus gives off radiation to form daughter nucleus' | | |

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