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 / λb 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) ΔE_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* $0.024 = \frac{1}{2} k \times (2.6 \times 10^{-2})^2$ *or* $\frac{1}{2} kd^2 = \frac{1}{2}k \times (2.6 \times 10^{-2})^2 - \frac{1}{2}kd^2$ C1

                      $0.012 = \frac{1}{2}k \times d^2$ $kd^2 = \frac{1}{2}k \times (2.6 \times 10^{-2})^2$ C1

                        d = 0.018 m d = 0.018 m

                             = 1.8 cm   = 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 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

                   $= 1170\,W$ 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'