CAMBRIDGE
INTERNATIONAL EXAMINATIONS

NOVEMBER 2002

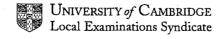### GCE Advanced Subsidiary Level

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MARK SCHEME

MAXIMUM MARK : 60

SYLLABUS/COMPONENT :9702 /2

**PHYSICS
(STRUCTURED QUESTIONS (AS))**

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1 (a) (i) mass / volume ...(ratio must be clear)............................ B1

     (ii) $kg \, m^{-3}$ OR kg / m^3 .... B1   [2]

  (b) v has unit of $m \, s^{-1}$ B1

    p / ρ has unit of $kg \, m^{-1} \, s^{-2}$ / $kg \, m^{-3}$ (no e.c.f. from (a)) M1

    $\sqrt{(p / \rho)}$ has unit of $m \, s^{-1}$ A1

    LHS = RHS so γ has no unit .... A0   [3]

2 (a) 1.6 ± 0.2 cm .... B1   [1]

  (b) $1.6 / 50 = 0.032$ ...(ignore any uncertainties)...................... B1   [1]

  (c) idea of adding fractional uncertainties C1

    $(0.2 / 1.6) + (0.1 / 50)$

    $= 0.127$ OR 12.7% ...(-2 marks if uncertainties not added) A1

    actual uncertainty $= (\pm) \, 0.004$ .... A1   [3]

    (do not allow more than 2 sig. fig)

3 (a) $v^2 = u^2 + 2as$ OR use of triangle etc C1

    $4.0^2 = 2 \times 9.8 \times s$ OR $s = \frac{1}{2} \times 4.0 \times 0.4$

    $s = 0.82$ m OR 0.80 m .... A1   [2]

  (b) $\Delta p = m(v - u)$ OR $p = mv$ C1

    speeds are $4.2 \, m \, s^{-1}$ and $3.6 \, m \, s^{-1}$ C1

    $\Delta p = 0.045 \, (4.2 + 3.6)$ (2/4 only if speeds not added) C1

       $= 0.35$ N s .... A1   [4]

    (1 mark only if only one speed used)

  (c) any time between 0.14 s and 0.17 s C1

    force $= \Delta p / \Delta t = 0.35 / 0.14$ (allow e.c.f.)

       $= 2.5$ N .... A1   [2]

4 (a) force $\times$ distance <u>moved</u> M1

    in the direction of the force .... A1   [2]

  (b) weight / force $= mg$ M1

    $\Delta E_p = mg \times \underline{\Delta h}$ .... A1   [2]

    (no marks for quote of $mg\Delta h$)

5 (a)   displacement & direction of energy travel normal to one another ... B1   [1]

   (b) (i)   phase angle of 60° correct .. (need to see 1½ wavelengths) B1
              lags behind T_1 .... B1   [2]

     (ii)   waves must be in same place (at same time) B1
           resultant <u>displacement</u> = sum of individual <u>displacements</u> .... B1   [2]

      (iii) 1. $-\frac{1}{2}A$ B1
           2. $\frac{1}{2}A$ ...... (allow e.c.f.) B1
           3.   zero ..... (allow e.c.f.) .... B1   [3]

6 (a) (i)   arrow in upward direction, foot near P B1

     (ii)   curved path consistent with **(i)** between plates B1
           then straight (with no kink at change-over) .... B1   [3]

   (b) $E = V/d$ C1
           $= 400 / (0.8 \times 10^{-2})$
           $= 5.0 \times 10^4 \, V \, m^{-1}$ .... (allow 1 sig fig) .... A1   [2]

   (c) (i) $F = Eq$ C1
           $= 5.0 \times 10^4 \times 1.6 \times 10^{-19}$
           $= 8.0 \times 10^{-15} \, N$ .... (allow 1 sig fig and e.c.f.) A1

     (ii) $a = F/m$ C1
           $= (8.0 \times 10^{-15}) / (9.1 \times 10^{-31})$
           $= 8.8. \times 10^{15} \, m \, s^{-2}$ ...... (allow 1 sig fig and e.c.f.) .... A1   [4]

   (d)   because F_E is normal to <u>horizontal</u> motion M1
           no effect .... A1   [2]

7 (a) (i) e.m.f. = energy / charge C1

$\qquad$ = $(1.6 \times 10^5) / (1.8 \times 10^4)$

$\qquad$ = 8.9 V A1

(ii) current = $\Delta Q / \Delta t$ C1

$\qquad$ = $(1.80 \times 10^4) / (1.3 \times 10^5)$

$\qquad$ = 0.14 A .... A1 [4]

(b) (i) energy $\propto R$ (or formula) C1

$\qquad$ energy = $(15 / 45) \times 1.14 \times 10^5$ C1

$\qquad$ = 3.7×10^4 J .... A1 [4]

(ii) energy dissipated in internal resistance (of battery) .... B1 [4]

$\qquad$ OR in <u>extra</u> resistance in circuit

8 (a) shows nucleon number as 220 .... B1

$\qquad$ shows proton number as 87 .... B1 [2]

(b) shows products as $_2^4$He OR $^4_2\alpha$ B1

$\qquad$ and $_{85}^{216}$At ....(allow e.c.f. from (a)) .... B1 [2]

9 (a) (i) stress = F / A C1

$\qquad$ = $25 / (1.7 \times 10^{-6})$

$\qquad$ = 1.47×10^7 Pa ......(do not allow 1 sig fig) A1

(ii) stress = $E \times$ strain C1

$\qquad$ $1.47 \times 10^7 = 7.1 \times 10^{10} \times (\Delta l / 1.8)$

$\qquad$ Δl = 0.37 mm .... A1 [4]

(b) $R = \rho l / A$ OR $R \propto L$ C1

$\qquad$ so, $\Delta R / R = \Delta l / l$ C1

$\qquad$ $\Delta R = (3.7 \times 10^{-4} / 1.8) \times 0.03 = 6.2 \times 10^{-6} \Omega$ .... A1 [3]

$\qquad$ May calculate $\rho = 2.833... \times 10^{-8} \Omega$ m

$\qquad$ giving new R as $3.0006167 \times 10^{-2} \Omega$

$\qquad$ hence ΔR - full credit possible

$\qquad$ However, if rounds off ρ as $2.83 \times 10^{-8} \Omega$ m,

$\qquad$ then $R_{new} < R_{old}$!

$\qquad$ Allow 1 mark only for $R \propto L$