CAMBRIDGE
INTERNATIONAL EXAMINATIONS

NOVEMBER 2002

GCE Advanced Subsidiary Level

MARK SCHEME

MAXIMUM MARK : 60

SYLLABUS/COMPONENT :9702 /2

PHYSICS
(STRUCTURED QUESTIONS (AS))

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

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 $s = ½ \times 4.0 \times 0.4$

$s = 0.82$ 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 × distance moved M1

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

(b) weight / force $= mg$ M1

$\Delta E_p = mg \times \Delta h$ ..... 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
= $(1.6 \times 10^5) / (1.8 \times 10^4)$
= 8.9 V A1

(ii) current = $\Delta Q / \Delta t$ C1
= $(1.80 \times 10^4) / (1.3 \times 10^5)$
= 0.14 A ..... A1 [4]

(b) (i) energy $\propto R$ (or formula) C1
energy = $(15 / 45) \times 1.14 \times 10^5$ C1
= 3.7×10^4 J A1

(ii) energy dissipated in internal resistance (of battery) ..... B1 [4]
OR in <u>extra</u> resistance in circuit

8 (a) shows nucleon number as 220 ..... B1
shows proton number as 87 ..... B1 [2]

(b) shows products as ^4_2He OR $^4_2\alpha$ B1
and $^{216}_{85}\text{At}$ ....(allow e.c.f. from (a)) ..... B1 [2]

9 (a) (i) stress = F / A C1
= $25 / (1.7 \times 10^{-6})$
= 1.47×10^7 Pa .....(do not allow 1 sig fig) A1

(ii) stress = $E \times$ strain C1
$1.47 \times 10^7 = 7.1 \times 10^{10} \times (\Delta l / 1.8)$
Δl = 0.37 mm ..... A1 [4]

(b) $R = \rho l / A$ OR $R \propto L$ C1
so, $\Delta R / R = \Delta l / l$ C1
$\Delta R = (3.7 \times 10^{-4} / 1.8) \times 0.03 = 6.2 \times 10^{-6}\ \Omega$ ..... A1 [3]

May calculate $\rho = 2.833\ldots \times 10^{-8}\ \Omega$ m
giving new R as $3.0006167 \times 10^{-2}\ \Omega$
hence ΔR - full credit possible

However, if rounds off ρ as $2.83 \times 10^{-8}\ \Omega$ m,
then $R_{new} < R_{old}$!
Allow 1 mark only for $R \propto L$