CAMBRIDGE
INTERNATIONAL EXAMINATIONS

June 2003

GCE ADVANCED SUBSIDIARY LEVEL AND ADVANCED LEVEL

MARK SCHEME

MAXIMUM MARK: 60

SYLLABUS/COMPONENT: 9702/02

PHYSICS
Paper 2 (Structured Questions (AS))

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

Categorisation of marks

The marking scheme categorises marks on the *MACB* scheme.

B marks: These are awarded as independent marks, which do not depend on other marks. For a B-mark to be scored, the point to which it refers must be seen specifically in the candidate's answer.

M marks: These are method marks upon which A-marks (accuracy marks) later depend. For an M-mark to be scored, the point to which it refers must be seen in the candidate's answer. If a candidate fails to score a particular M-mark, then none of the dependent A-marks can be scored.

C marks: These are compensatory method marks which can be scored even if the points to which they refer are not written down by the candidate, providing subsequent working gives evidence that they must have known it. For example, if an equation carries a C-mark and the candidate does not write down the actual equation but does correct working which shows he/she knew the equation, then the C-mark is awarded.

A marks: These are accuracy or answer marks which either depend on an M-mark, or allow a C-mark to be scored.

Conventions within the marking scheme

BRACKETS
Where brackets are shown in the marking scheme, the candidate is not required to give the bracketed information in order to earn the available marks.

UNDERLINING
In the marking scheme, underlining indicates information that is essential for marks to be awarded.

1 kg m^{-3} B1
frequency or count rate or activity or decay constant B1
NC^{-1} or V m^{-1} or kg m s^{-2} C^{-1} etc. B1
momentum or impulse..... B1 [4]
(Allow solidus notation and non SI units)

2 (a) (i) distance from a (fixed) point.....M1
in a specified direction A1
(Allow 1 mark for 'distance in a given direction')

(ii) (displacement from start is zero if) car at its starting position..... B1 [3]

(b) (i)1 $v^2 = u^2 + 2as$
$28^2 = 2 \times a \times 450$ (use of component of 450 scores no marks)..... C1
a = 0.87 m s^{-2} ..... A1 [2]
(-1 for 1 sig. fig. but once only in the question)

(i)2 $v = u + at$ or any appropriate equation
28 = 0.87t or appropriate substitution..... C1
t = 32 s ..... A1 [2]

(i)3 $E_k = \frac{1}{2}mv^2$ C1
$= \frac{1}{2} \times 800 \times 28^2$
$= 3.14 \times 10^5$ J..... A1 [2]

(i)4 $E_p = mgh$ C1
$= 800 \times 9.8 \times 450 \sin 5$ C1
$= 3.07 \times 10^5$ J ..... A1 [3]

(ii) power = energy/time C1
$= (6.21 \times 10^5)/32.2$ C1
$= 1.93 \times 10^4$ W ..... A1 [3]
(power = Fv with $F = mg \sin\theta$ scores no marks)

(iii) some work also done against friction forces.....M1
location of frictional forces identified ..... A1 [2]
(allow reasonable alternatives)

3 (a) (i) ductile B1

(ii)1 L shown at end of straight line B1

(ii)2 reciprocal of gradient of straight line region ..... B1 [3]

(b) (i)1 circumference = 3π cm or arc = $r\theta$ C1
extension = (6.5/360) x 3π = 1.5 sin (or tan) 6.5.....M1
= 0.17 cm A0

(i)2 strain = extension/length..... C1
= 0.17/250
= 6.8×10^{-4} ..... A1 [4]

(ii) stress = force/area..... C1
$= (6.0 \times 9.8)/(7.9 \times 10^{-7})$ C1
$= 7.44 \times 10^7$ Pa ..... A1 [3]

(iii) Young modulus = stress/strain C1
= $(7.44 \times 10^{7})/(6.8 \times 10^{-4})$
= 1.1×10^{11} Pa ..... A1 [2]

(iv) remove extra load and see if pointer returns to original position or wire returns to original length ..... B1 [1]

4 (a) e.g. both transverse/longitudinal/same type
meet at a point,
same direction of polarisation, etc.....1 *each, max 3* ..... B3 [3]
(allow 1 mark for any condition for observable interference)

(b) (i)1 allow 0.3 mm $\rightarrow$ 3 mm..... B1

(i)2 $\lambda = ax/D$ (allow any subject)..... B1

(ii)1 separation increased..... B1
less bright B1

(ii)2 separation increased..... B1
less bright B1

(ii)3 separation unchanged..... B1
fringes brighter..... B1
further detail, i.e quantitive aspect in (ii)1 or (ii)2..... B1 [7]
(in (b), do not allow e.c.f. from (b)(i)2)

5 (a) (i) resistance = V/I C1
= $6.0/(40 \times 10^{-3})$
= 150 Ω A1
(no marks for use of gradient)

(ii) at 8.0 V, resistance = $8.0/(50 \times 10^{-3})$ = 160 Ω..... C1
change = 10 Ω ..... A1 [4]

(b) (i) straight line through origin.....M1
passes through I = 40 mA, V = 8.0V A1

(ii) current in both must be 40 mA C1
e.m.f. = 8.0 + 6.0 = 14.0 V ..... A1 [4]

6 (a) (i) curve is not smooth, fluctuations, etc B1

(ii) curve is same shape or same half-life, not affected by temperature, etc..... ..... B1 [2]

(b) (i) 134..... ..... B1 [1]

(ii) α-particle shown as $^{4}_{2}\mathrm{He}$ or as $^{4}_{2}\alpha$ B1
nucleon number of Po shown as 216 ..... B1
proton number of Po shown as 84..... B1
[3]