CAMBRIDGE
INTERNATIONAL EXAMINATIONS

JUNE 2002

GCE Advanced Subsidiary Level

MARK SCHEME

MAXIMUM MARK : 60

SYLLABUS/COMPONENT :9702 /2

PHYSICS
(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 (a) allow 50 g - 500 g ..... B1 [1]

(b) allow 3 MJ - 4 MJ ..... B1 [1]

(c) allow $(6.0 - 8.0) \times 10^{-7}$ m ..... B1 [1]

(d) allow $(5 \times 10^{4}) \rightarrow (5 \times 10^{5})$ Pa ..... B1 [1]

(Ignore sig. fig. in **(a)**, **(b)**, **(c)** and **(d)**.

2 (a) because all readings have same error
OR can't be eliminated by repeating and averaging B1
error is systematic ..... B1 [2]
(do not allow 'systematic' if argument is fallacious)

(b) micrometer measures to fraction of millimetre so is precise
OR if repeated, reading is (almost constant) B1
but all readings have error so is not accurate ..... B1 [2]

3 (a) point at which (whole) weight of body M1
may be considered to act ..... A1 [2]
(allow definition based on gravitational force)

(b) (i) 380 N B1
(ii) position nearer A than B B1
(iii) clear indication about which point moments are taken B1
e.g. $950 \times x = 380 \times 1.7$ C1
$x = 68$ cm C1
distance = 108 cm or 1.08 m (accept 2 sig fig) ..... A1 [6]

4 (a) $v^2 = 2gh$
$v^2 = 2 \times 9.8 \times 1.6$ C1
$v = 5.6\ \text{m s}^{-1}$ ..... A1 [2]

(b) (i) working leading to idea that $h = 0.90 \times 1.6$ C1
$h = 1.44$ m A1
(ii) $mgh = \frac{1}{2}mv^2$
$v^2 = 2 \times 9.8 \times 1.44$ C1
$v = 5.3\ \text{m s}^{-1}$ ..... A1 [4]

(c) $\Delta p = m(v - u)$ OR $p = mv$ C1
$m = 0.073$ kg
$\Delta p = 0.073 \times (5.6 + 5.3)$ C1
$= 0.80$ N s ..... A1 [3]

(d) steel plate (and Earth) B1
must gain momentum of 0.80 N s M1
in downward direction ..... A1 [3]
(idea of Earth/plate and ball as the system scores 1/3)

5 (a) increase the height of the cylinder ..... B1 [1]

(b) take heat out of gas OR expand gas OR cool it ..... B1 [1]

(c) compress the gas OR increase pressure OR heat at constant volume ..... B1 [1]

6 (a) (i) top plate positive B1
(ii) $E = V/d$ C1
$V = 3.0 \times 10^4 \times 1.2 \times 10^{-2}$
$= 360$ V ..... A1 [3]

(b) $F = ma$ C1
$3.0 \times 10^4 \times 1.6 \times 10^{-19} = 9.1 \times 10^{-31} a$ C1
$a = 5.3 \times 10^{15}\ \text{m s}^{-2}$ ..... A1 [3]

7 **(a)** Fig. 6.1(a): approximately circular wavefronts M1
centred on gap A1
constant wavelength (allow this in **(a)** or **(b)** B1
Fig. 6.1(b): wavefronts plane at centre M1
curved at edges ..... A1 [5]

(b) $\theta = \frac{1}{2}(162 - 136) = 13°$ C1
$d \sin\theta = n\lambda$ C1
$d \sin 13 = 2 \times 630 \times 10^{-9}$ C1
$d = 5.6 \times 10^{-6}$ m ..... A1 [4]
(Use of $\theta = 162°$ or 136°, max 2/4)

(c) e.g. more slits for light to pass through
narrow so more diffracted light and 'off-axis' fringes clearer ..... B1 [1]

8 **(a)** **(i)** two resistors in series B1
(ii) two resistors in parallel B1
(iii) any correct combination ..... B2 [4]
(1/2 only in **(iii)** if connections to external circuit not clear)

(b) **(i)** $P = I^2R$
$0.81 = 100\, I^2$ C1
$I = 0.090$ A A1
(ii) current in 25 Ω resistor = 0.045 A C1
power = 0.051 W ..... A1 [4]

9 **(a)** α-particles not able to penetrate air between source and window ..... B1 [1]

(b) **(i)** rapid drop in count rate B1
for small thicknesses (up to 2 mm)
OR most β's stopped by few mm of aluminium B1
(ii) very slow drop-off in count rate B1
for thicknesses greater than 2 mm
OR γ much higher penetration than β ..... B1 [4]
(do not allow 'γ not stopped by aluminium')