UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Level

MARK SCHEME for the May/June 2006 question paper

9702 PHYSICS

9702/02 Paper 2

Maximum raw mark 60

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which Examiners were initially instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began. Any substantial changes to the mark scheme that arose from these discussions will be recorded in the published *Report on the Examination*.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the *Report on the Examination*.

The minimum marks in these components needed for various grades were previously published with these mark schemes, but are now instead included in the Report on the Examination for this session.

- CIE will not enter into discussion or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the May/June 2006 question papers for most IGCSE and GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

UNIVERSITY of CAMBRIDGE
International Examinations

1 **(a)** kg m s^{-2} B1 **[1]**

(b) kg m^{-1} s^{-1} B1 **[1]**

(c) **(i)** $v^2 = 2gs$
$= 2 \times 9.8 \times 4.5$ C1
$v = 9.4$ m s^{-1} A1 **[2]**

(ii) *either*
F $(= 3.2 \times 10^{-4} \times 1.2 \times 10^{-2} \times 9.4) = 3.6 \times 10^{-5}$ N M1
weight of sphere $(= mg = 15 \times 10^{-3} \times 9.8) = 0.15$ N M1
$3.6 \times 10^{-5} << 0.15$, so justified A1 **[3]**
or
$mg = crv_T$ (M1)
terminal speed $= 3.8 \times 10^4$ m s^{-1} (M1)
$9.4 << 3.8 \times 10^4$, so justified (A1)

2 **(a)** **(i)** point at which whole weight of body M1
may be considered to act A1 **[2]**

(ii) sum of forces in any direction is zero B1
sum of moments about any point is zero B1 **[2]**

(b) *either*:
T and W have zero moment about P M1
so F must have zero moment, i.e. pass through P A1 **[2]**
or:
if all pass through P, distance from P is zero for all forces (M1)
so sum of moments about P is zero (A1)

(c) **(i)** $F\cos\alpha = T\cos\beta$ B1 **[1]**

(ii) $W = F\sin\alpha + T\sin\beta$ B1 **[1]**

(iii) $2W = 3T\sin\beta$ B1 **[1]**

3 **(a)** sum of (random) kinetic and potential energies M1
of the atoms/molecules of the substance A1 **[2]**

(b) **(i)** potential energy unchanged as atoms remain in same positions M1
allow 'reduced because atoms slightly closer together'
vibrational kinetic energy reduced because temperature lower M1
so internal energy less A1 **[3]**

(ii) potential energy increases because separation increases M1
kinetic energy unchanged because temperature unchanged M1
so internal energy increases A1 **[3]**

4 **(a)** mass per unit volume (*ratio idea must be clear, not units*) B1 **[1]**

(b) **(i)** pressure is same at the surface of <u>mercury</u>
because at same horizontal level B1 **[1]**

(ii) $h\rho g$ is same for both B1
$53 \times 10^{-2} \times 1.0 \times 10^3 \times g = 71 \times 10^{-2} \times \rho \times g$ C1
$\rho = 7.5 \times 10^2$ kg m^{-3} A1 [3]

© University of Cambridge International Examinations 2006

5 **(a)** no hysteresis loop/no permanent deformation M1
(*do not allow 'force proportional to extension')*
so elastic change A0 **[1]**

(b) work done = area under graph line OR average force × distance B1
= ½Fx ½$(F_2 + F_1)(x_2 - x_1)$ A1
$F = kx$, so work done = = ½kx^2 ½$k(x_2 + x_1)(x_2 - x_1)$ A1
work done = ½$k(x_2^2 - x_1^2)$ A0 **[3]**

(c) gain in energy of trolley = ½$k(0.060^2 - 0.045^2)$ + ½$k(0.030^2 - 0.045^2)$ C1
= 0.36 J C1
kinetic energy = ½ × 0.85 × v^2 = 0.36 C1
v = 0.92 m s^{-1} A1 **[4]**

6 **(a)** **(i)** correct shape drawn B1 **[1]**

(ii) two nodes marked correctly B1 **[1]**

(b) ½λ = 0.324 m C1
$v = f\lambda$ C1
= 512 × 2 × 0.324
= 332 m s^{-1} A1 **[3]**

(c) ¼λ = 16.2 cm C1
either antinode is 0.5 cm above top of tube
or antinode is 16.2 cm above water surface A1 **[2]**

7 **(a)** lamp C M1
lamp is shorted A1 **[2]**

(b) shorted <u>lamp A</u> would cause damage to the supply/lamps
/blow fuse in supply B1 **[1]**

(c) 15 Ω B1 **[1]**

(d) **(i)** $V = I R$ C1
R = 30 Ω A1 **[2]**

(ii) $P = VI$ *or* I^2R *or* V^2 / R C1
P = 1.2 W A1 **[2]**

(e) filament is cold when measuring with ohm-meter in (b) B1
resistance of filament rises as temperature rises B1 **[2]**

8 **(a)** nucleus emits M1
α- or β- particles and/or γ-rays A1 **[2]**

(b) decay unaffected by environmental changes M1
such as temperature, pressure etc. (*one e.g. is sufficient)* A1 **[2]**

(c) constant probability of decay (per unit time) of a nucleus B1
cannot predict which particular nucleus will decay next B1 **[2]**

© University of Cambridge International Examinations 2006