UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2010 question paper

for the guidance of teachers

9702 PHYSICS

9702/23 Paper 2 (AS Structured Questions), maximum raw mark 60

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1 (a) (i) 1% of ±2.05 is ±0.02 — A1 [1]

(ii) max. value is 2.08 V — A1 [1]

(b) there may be a zero error/calibration error/systematic error — M1
which makes all readings either higher or lower than true value — A1 [2]

2 (a) no resultant force/sum of forces zero — B1
no resultant moment/torque/sum of moments/torques zero — B1 [2]

(b) (i) each force is represented by the side of a triangle/by an arrow — M1
in magnitude and direction — A1
arrows joined, head to tail — B1 [3]
(*could be shown on a sketch diagram*)

(ii) if the triangle is 'closed' (then the forces are in equilibrium) — B1 [1]

(c) triangle drawn with correct shape (incorrect arrows loses this mark) — B1
$T_1 = 5.4 \pm 0.2\,\text{N}$ — B1
$T_2 = 4.0 \pm 0.2\,\text{N}$ — B1 [3]

(d) forces in strings would be horizontal — B1
(so) no vertical force to support the weight — B1 [2]

3 (a) evidence of use of area below the line — B1
distance = 39 m (*allow ±0.5 m*) — A2 [3]
(*if > ±0.5 m but ≤ 1.0 m, then allow 1 mark*)

(b) (i) 1 $E_K = \frac{1}{2}mv^2$ — C1
$\Delta E_K = \frac{1}{2} \times 92 \times (6^2 - 3^2)$
$= 1240$ J — A1 [2]

2 $E_P = mgh$ — C1
$\Delta E_P = 92 \times 9.8 \times 1.3$
$= 1170$ J — A1 [2]

(ii) $E = Pt$ — C1
$E = 75 \times 8$
$= 600$ J — A1 [2]

(c) (i) energy = (1240 + 600) – 1170 — M1
= 670 J — A0 [1]

(ii) force = 670/39 = 17 N — A1 [1]

(d) frictional forces include air resistance — B1
air resistance decreases with decrease of speed — B1 [2]

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4 **(a)** **(i)** solid has fixed volume and fixed shape/incompressible B1 [1]

(ii) gas fills any space into which it is put B1 [1]

(b) atoms/molecules have (elastic) collisions with the walls (of the vessel) B1
momentum of atom/molecule changes B1
so impulse (on wall)/force on wall B1
random motion/many collisions (per unit time) gives rise to
(constant) force/pressure B1 [4]

(c) spacing (much) greater in gases than in liquids/about ten times C1
either spacing depends on $1/\sqrt[3]{\rho}$
or ratio of spacings is about 8.8 A1 [2]

5 **(a)** **(i)** **1** number of oscillations per unit time (not per second) B1 [1]
2 $n\lambda$ A1 [1]

(ii) v = distance / time = $n\lambda/t$ M1
$n/t = f$ hence $v = f\lambda$ A1
or f oscillations per unit time so $f\lambda$ is distance per unit time M1
distance per unit time is v so $v = f\lambda$ A1 [2]

(b) **(i)** 1.0 period is 3 × 2 = 6.0 ms C1
frequency = $1/(6 \times 10^{-3})$ = 170 Hz A1 [2]

(ii) wave (with approx. same amplitude and) with correct phase difference B1 [1]

6 **(a)** **(i)** movement/flow of charged particles B1 [1]

(ii) work done per unit charge (transferred) B1 [1]

(b) straight line through origin B1
resistance = V/I, with values for V and I shown M1
= 20 Ω A0 [2]
(using the gradient loses the last mark)

(c) **(i)** 0.5 A A1 [1]

(ii) *either* resistance of each resistor is 20 Ω *or* total current = 0.8 A C1
either combined resistance = 10 Ω *or* $R = E/I$ = 10 Ω A1 [2]

(d) **(i)** 10 V A1 [1]

(ii) power = EI C1
= 10 × 0.2 = 2.0 W A1 [2]

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7 (a) (i) *either* helium nucleus
or particle containing two protons and two neutrons — B1 [1]

(ii) allow any value between 1 cm and 10 cm — B1 [1]

(b) (i) energy = $(8.5 \times 10^{-13})/(1.6 \times 10^{-13})$ — M1
= 5.3 MeV — A0 [1]

(ii) number = $(5.3 \times 10^{6})/31$ — C1
= 1.7×10^{5} (*allow 2 s.f. only*) — A1 [2]

(iii) number per unit length = (1.7×10^{5}) / **(a)(ii)**
correct numerical value — A1
correct unit — B1 [2]

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