UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2008 question paper

9702 PHYSICS

9702/02 Paper 2 (AS Structured Questions), maximum raw mark 60

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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.

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1 (a) (i) $Q = It$ (*allow any subject for the equation*) B1 [1]

(ii) I B1
t B1 [2]
(*allow 1 mark only if all three quoted*)

(b) (i) base unit of I is A
base unit of n is m^{-3} (*not* $/m^{-3}$)
base unit of S is m^2
base unit of q is A s (*not C*)
base unit of v is $m\ s^{-1}$
(*–1 for each error or omission*) B3 [3]

(ii) $A = m^{-3}\ m^2\ A\ s\ (m\ s^{-1})^k$ M1
e.g. for m: $0 = -3 + 2 + k$
$k = 1$ A1 [2]

2 (a) (i) $v^2 = 2as$
$v^2 = 2 \times 0.85 \times 9.8 \times 12.8$ C1
$v = 14.6\ m\ s^{-1}$ A1 [2]

(ii) time = 29.3 / 14.6 C1
= 2.0 s A1 [2]
(*any acceleration scores 0 marks; allow 1 s.f.*)

(b) *either* $60\ km\ h^{-1} = 16.7\ m\ s^{-1}$
or $14.6\ m\ s^{-1} = 53\ km\ h^{-1}$
or $22.1\ m\ s^{-1} = 79.6\ km\ h^{-1}$ M1
so driving within speed limit A1
but reaction time is too long / too slow B1 [3]

3 (a) moment: force × <u>perpendicular</u> distance M1
of force from pivot / axis / point A1
couple: (magnitude of) one force × <u>perpendicular</u> distance M1
between the two forces A1 [4]
(*penalise the 'perpendicular' omission once only*)

(b) (i) $W \times 4.8 = (12 \times 84) + (2.5 \times 72)$ C1
$W = 250$ N (248 N) A1 [2]

(ii) *either* friction <u>at the pivot</u> *or* small movement of weights B1 [1]

4 (a) (i) *either* force = e × (V / d) *or* $E = V/d$ C1
$= 1.6 \times 10^{-19} \times (250 / 7.6 \times 10^{-3})$ C1
$= 5.3 \times 10^{-15}$ N A1 [3]

(ii) *either* $\Delta E_K = eV$ *or* $\Delta E_K = Fd$ C1
$= 1.6 \times 10^{-19} \times 250$ $= 5.3 \times 10^{-15} \times 7.6 \times 10^{-3}$ M1
$= 4.0 \times 10^{-17}$ J A0 [2]
(*allow full credit for correct working via calculation of a and v*)

(iii) *either* $\Delta E_K = \frac{1}{2}mv^2$
$4.0 \times 10^{-17} = \frac{1}{2} \times 9.1 \times 10^{-31} \times v^2$ C1
$v = 9.4 \times 10^6$ m s^{-1} A1 [2]
or $v^2 = 2as$ and $a = F/m$
$v^2 = (2 \times 5.3 \times 10^{-15} \times 7.6 \times 10^{-3})/(9.11 \times 10^{-31})$ (C1)
$v = 9.4 \times 10^6$ m s^{-1} (A1)

(b) speed depends on (electric) potential difference M2
(*If states ΔE_K does not depend on uniformity of field, then award 1 mark, treated as an M mark*)
so speed always the same A1 [3]

5 **(a)** haphazard / random / erratic / zig-zag movement M1
of (smoke) particles (*do not allow molecules / atoms*) A1 [2]

(b) motion is due to unequal / unbalanced collision rate**s** (on different faces) B1
(unequal collision rate due to) random motion of (gas) molecules / atoms B1 [2]

(c) *either* collisions with air molecules average out M1
this prevents haphazard motion A1 [2]
or particle is more massive / heavier / has large inertia (M1)
collision**s** cause only small movements / accelerations (A1)

6 **(a)** wave incident at an edge / aperture / slit /(edge of) obstacle M1
bending / spreading of wave (into geometrical shadow) A1 [2]
(*award 0/2 for bending at a boundary*)

(b) **(i)** apparatus e.g. laser & slit / point source & slit / lamp and slit & slit
microwave source & slit
water / ripple tank, source & barrier B1
detector e.g. screen
aerial / microwave probe
strobe / lamp B1
what is observed B1 [3]

(ii) apparatus e.g. loudspeaker, and slit / edge B1
detector e.g. microphone & c.r.o. / ear B1
what is observed B1 [3]

7 **(a)** *either* $V = IP$ B1
current in circuit = $E / (P + Q)$ B1
hence $V = EP / (P + Q)$ A0 [2]
or current is the same throughout the circuit (M1)
$V / P = E / (P + Q)$ (A1)
hence $V = EP / (P + Q)$ (A0)

(b) (i) (as temperature rises), resistance of (thermistor) decreases M1
either resistance of parallel combination decreases
or p.d. across 5 kΩ resistor / thermistor decreases M1
p.d. across 2000 Ω resistor / voltmeter reading increases A1 [3]

(ii) if R is the resistance of the parallel combination,
either $3.6 = (2 \times 6) / (2 + R)$ *or* current in 2 kΩ resistor = 1.8 mA C1
R = 1.33 kΩ current in 5 kΩ resistor = 0.48 mA C1
$\frac{1}{1.33} = \frac{1}{5} + \frac{1}{T}$ current in thermistor = 1.32 mA C1
T = 1.82 kΩ $T = 2.4 / 1.32 = 1.82$ kΩ A1 [4]

8 (a) nucleus has constant probability of decay M1
per unit time / in a given time A1 [2]
(*allow 1 mark for 'cannot predict which nucleus will decay next'*)

(b) (i) count rate / activity decreases B1 [1]

(ii) count rate fluctuates / is not smooth B1 [1]

(c) *either* the (decay) curves are similar / same
or curves indicate same half-life B1 [1]