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

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began.

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* $\Delta E_K = ½mv^2$
$4.0 \times 10^{-17} = ½ \times 9.1 \times 10^{-31} \times v^2$ 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)** <u>nucleus</u> has constant probability of decay — M1
per unit time / in a given time — A1 [2]
(*allow 1 mark for 'cannot predict which <u>nucleus</u> 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]