

**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.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

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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  $\times$  perpendicular distance M1  
 of force from pivot / axis / point A1  
 couple: (magnitude of) one force  $\times$  perpendicular 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 at the pivot or small movement of weights B1 [1]
- 4 (a) (i) either force =  $e \times (V / d)$  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  $v$ )

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- (iii) either  $\Delta E_K = \frac{1}{2}mv^2$   
 $4.0 \times 10^{-17} = \frac{1}{2} \times 9.1 \times 10^{-31} \times v^2$   
 $v = 9.4 \times 10^6 \text{ m s}^{-1}$   
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)  
 $v = 9.4 \times 10^6 \text{ m s}^{-1}$  (A1)
- (b) speed depends on (electric) potential difference M2  
*(If states  $\Delta E_K$  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 rates (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)  
collisions 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)

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- (b) (i) (as temperature rises), resistance of (thermistor) decreases M1  
*either* resistance of parallel combination decreases M1  
*or* p.d. across 5 k $\Omega$  resistor / thermistor decreases A1  
p.d. across 2000  $\Omega$  resistor / voltmeter reading increases [3]
- (ii) if  $R$  is the resistance of the parallel combination,  
*either*  $3.6 = (2 \times 6) / (2 + R)$  *or* current in 2 k $\Omega$  resistor = 1.8 mA C1  
 $R = 1.33$  k $\Omega$  current in 5 k $\Omega$  resistor = 0.48 mA C1  
 $\frac{1}{1.33} = \frac{1}{5} + \frac{1}{T}$  current in thermistor = 1.32 mA C1  
 $T = 1.82$  k $\Omega$   $T = 2.4 / 1.32 = 1.82$  k $\Omega$  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 B1 [1]  
*or* curves indicate same half-life