UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary and Advanced Level

MARK SCHEME for the November 2004 question paper

9702 PHYSICS

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

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. This 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*.

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Grade thresholds taken for Syllabus 9702 (Physics) in the November 2004 examination.

	maximum mark available	minimum mark required for grade:		
		A	B	E
Component 2	60	41	37	25

The thresholds (minimum marks) for Grades C and D are normally set by dividing the mark range between the B and the E thresholds into three. For example, if the difference between the B and the E threshold is 24 marks, the C threshold is set 8 marks below the B threshold and the D threshold is set another 8 marks down. If dividing the interval by three results in a fraction of a mark, then the threshold is normally rounded down.

November 2004

GCE A AND AS LEVEL

MARK SCHEME

MAXIMUM MARK: 60

SYLLABUS/COMPONENT: 9702/02

PHYSICS
Paper 2 (Structured)

UNIVERSITY of CAMBRIDGE
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1 (a) (i) e.g. check for zero error (on micrometer)/zero the micrometer **B1**

(ii) take readings along the length of the wire/at different points **B1**

(iii) take readings spirally/around the wire **B1 [3]**

(b) (i) 4% **A1**

(ii) 8% **A1 [2]**

2 (a) all same speed in a vacuum (allow medium)/all travel in a vacuum (1)

transverse/can be polarised (1)

undergo diffraction/interference/superposition (1)

can be reflected/refracted (1)

show properties of particles (1)

oscillating electric and magnetic fields (1)

transfer energy/progressive (1)

not affected by electric and magnetic fields (1)

(allow any three, 1 each) **B3 [3]**

(b) 495 nm = 495 x 10^{-9} m **C1**

number = 1/(495 x 10^{-9}) = 2.02 x 10^{6} **A1 [2]**

(allow 2 or more significant figures)

(c) (i) allow $10^{-7} \rightarrow 10^{-11}$ m **B1**

(ii) allow $10^{-3} \rightarrow 10^{-6}$ m **B1 [2]**

3 (a) constant gradient/straight line **B1 [1]**

(b) (i) 1.2 s **A1**

(ii) 4.4 s **A1 [2]**

(c) *either* use of area under line *or h* = average speed x time **C1**

h = ½ x (4.4 – 1.2) x 32 **C1**

= 51.2 m **A1 [3]**

(allow 2/3 marks for determination of *h* = 44 m or *h* =58.4 m
allow 1/3 marks for answer 7.2 m)

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(d) $\Delta p = m\Delta v$ OR $p = mv$ **C1**

$= 0.25 \times (28 + 12)$ **C1**

$= 10$ N s **A1** **[3]**

(answer 4 N s scores 2/3 marks)

3 **(e)** **(i)** total/sum momentum before = total/sum momentum after **B1**

in any closed system **B1** **[2]**

(ii) *either* the system is the ball and Earth **B1**

momentum of Earth changes by same amount **B1**

but in the opposite direction **B1**

or Ball is not an isolated system/there is a force on the ball (B1)

Gravitational force acts on the ball (B1)

causes change in momentum/law does not apply here (B1) **[3]**

(if explains in terms of air resistance, allow first mark only)

4 **(a)** wavelength = 1.50 m **B1** **[1]**

(b) $v = f\lambda$ **C1**

speed = 540 m s^{-1} **A1** **[2]**

(c) (progressive) wave reflected at the (fixed) ends **B1**

wave is formed by superposition of (two travelling) waves **B1**

this quantity is the speed of the travelling wave **B1** **[3]**

5 **(a)** **(i)** F/A **B1**

(ii) $\Delta L/L$ **B1**

(iii) $FL/A.\Delta L$ **B1** **[3]**

(b) **(i)** $\Delta L = 0.012 \times 0.62 \times 350$ **M2**

$= 2.6$ mm **A0** **[2]**

(ii) $2.0 \times 10^{11} = (F \times 0.62)/(7.9 \times 10^{-7} \times 2.6 \times 10^{-3})$ **C1**

$F = 660$ N **A1** **[2]**

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(iii) *either* stress when cold = 660/(7.9 x 10^{-7}) = 840 MPa

or tension at uts = 198 N **M1**

either this is greater than the ultimate tensile stress

or tension at uts is less then tension in **(ii)** **A1**

the wire will snap **A1** **[3]**

(Allow possibility for the two 'A' marks to be scored as long as some quantitative answer – even if incorrect – has been given for the 'M' mark)

6 (a) (i) resistance is ratio *V/I* (at a point) **B1**

either gradient increases or *I* increases more rapidly than V **B1** **[2]**

(If states R = reciprocal of gradient, then 0/2 marks here)

(ii) current = 2.00 mA **C1**

resistance = 2 000 Ω **A1** **[2]**

(b) (i) straight line from origin **M1**

passing through (6.0 V, 4.0 mA) (allow ½ square tolerance) **A1** **[2]**

(ii) individual currents are 0.75 mA and 1/33 mA **C1**

current in battery = 2.1 mA **A1** **[2]**

(allow argument in terms of $P = I^2R$ or IV)

(c) same current in R and in C **M1**

p.d. across C is larger than that across R **M1**

so since power = *VI*, greater in C **A1** **[3]**

(allow argument in terms of $P = I^2R$ or IV)

7 (a) (i) nucleus is small **M1**

in comparison to size of atom **A1** **[2]**

(ii) nucleus is massive/heavy/dense **B1**

and charged (allow to be scored in **(i)** or **(ii)**) **B1** **[2]**

(b) (i) symmetrical path and deviation correct w.r.t. position of nucleus **B1**

deviation less than in path AB **B1**

(ii) deviation > 90° and in correct direction **B1** **[3]**

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