UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary and Advanced Level

MARK SCHEME for the June 2005 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*.

- CIE will not enter into discussion or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the June 2005 question papers for most IGCSE and GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

Grade thresholds for Syllabus 9702 (Physics) in the June 2005 examination.

	maximum mark available	minimum mark required for grade:		
		A	B	E
Component 2	60	43	39	26

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.

June 2005

GCE A AND AS LEVEL

MARK SCHEME
MAXIMUM MARK: 60
SYLLABUS/COMPONENT: 9702/02 **PHYSICS** **Paper 2 (Structured)**

UNIVERSITY *of* CAMBRIDGE
International Examinations

1	(a)	allow 100 m s^{-1} → 900 m s^{-1}	B1	[1]
	(b)	allow 0.5 kg m^{-3} → 1.5 kg m^{-3}	B1	[1]
	(c)	allow 5 g → 50 g	B1	[1]
	(d)	allow 2×10^3 cm^3 → 9×10^3 cm^3	B1	[1]
2	(a)	speck of light	B1	
		that moves haphazardly/randomly/jerkily/etc.	B1	[2]
	(b)	randomness of collisions would be 'averaged out'	B1	
		so less (haphazard) movement	B1	[2]
		(do not allow 'more massive so less movement')		
3	(a) (i)	$\Delta E_p = mg\Delta h$	C1	
		$= 0.602 \times 9.8 \times 0.086$		
		= 0.51 J	A1	[2]
		(do not allow g = 10, m = 0.600 or answer 0.50 J)		
	(ii)	v^2 = (2gh =) $2 \times 9.8 \times 0.086$ <u>or</u> (2 x 0.51)/0.602	M1	
		v = 1.3 (m s^{-1})	A0	[1]
	(b)	$2 \times V = 602 \times 1.3$ (allow 600)	C1	
		V = 390 m s^{-1}	A1	[2]
	(c) (i)	$E_k = ½mv^2$	C1	
		$= ½ \times 0.002 \times 390^2$		
		= 152 J or 153 J or 150 J	A1	[2]
	(ii)	E_k not the same/changes		
		<u>or</u> E_k before impact>E_k after/E_p after	M1	
		so must be inelastic collision	A1	[2]
		(allow 1 mark for 'bullet embeds itself in block' etc.)		
4	(a)	brittle	B1	[1]
	(b) (i)	stress = force/area	C1	
		$= 60/(7.9 \times 10^{-7})$		
		$= 7.6 \times 10^7$ Pa	A1	[2]
	(ii)	Young modulus = stress/strain	C1	
		limiting strain = 0.03/24 (= 1.25×10^{-3})	C1	
		Young modulus = $(7.6 \times 10^7)/(1.25 \times 10^{-3}) = 6.1 \times 10^{10}$ Pa	A1	[3]
	(iii)	energy = $½ \times 60 \times 3.0 \times 10^{-4}$	C1	
		$= 9.0 \times 10^{-3}$ J	A1	[2]
	(c)	If hard, ball does not deform (much)	B1	
		and <u>either</u> (all) kinetic energy converted to strain energy	B1	
		If soft, E_k becomes strain energy of ball and window	B1	
		(no mention of <u>strain</u> energy, max 2 marks)		
		<u>or</u> impulse for hard ball takes place over shorter time (B1)		
		larger force/greater stress (B1)		[3]

5	(a)	When a wave (front) is incident on an edge or an obstacle/slit/gap Wave 'bends' into the geometrical shadow/changes direction/spreads	 M1 A1	 [2]
	(b) (i)	$d = 1/(750 \times 10^3)$ $= 1.33 \times 10^{-6}$ m	C1 A1	 [2]
	(ii)	$1.33 \times 10^{-6} \times \sin 90° = n \times 590 \times 10^{-9}$ $n = 2$ (must be an integer)	C1 A1	 [2]
	(iii)	formula assumes no path difference of light before entering grating or there is a path difference before the grating	 B1	 [1]
	(c)	e.g. lines further apart in second order lines fainter in second order (allow any sensible difference: 1 each, max 2) (if differences stated but without reference to the orders, max 1 mark)	 B2	 [2]
6	(a) (i)	lines normal to plate and equal spacing (at least 4 lines) direction from (+) to earthed plate	B1 B1	 [2]
	(ii)	$E = 160/0.08$ $= 2.0 \times 10^3$ V m^{-1}	M1 A0	 [1]
	(b) (i)	correct directions with line of action of arrows passing through charges	 B1	 [1]
	(ii)	force $= Eq$ $= 2.0 \times 10^3 \times 1.2 \times 10^{-15}$ $= 2.4 \times 10^{-12}$ N	C1 A1	 [2]
	(iii)	couple = force × perpendicular separation $= 2.4 \times 10^{-12} \times 2.5 \times 10^{-3} \times \sin 35°$ $= 3.4(4) \times 10^{-15}$ N m	M1 A1	 [2]
	(iv)	either **rotates** to align with the field or **oscillates** (about a position) with the positive charge nearer to the earthed plate/clockwise	 M1 A1	 [2]
7	(a)	potential difference/current	B1	[1]
	(b) (i)	**1)** 1.13 W **2)** 1.50 V	 B1	 [1]
	(ii)	power = V^2 / R or power = VI and $V = IR$ $R = 1.50^2/1.13$ $= 1.99\ \Omega$	C1 A1	 [2]

	(iii)	either $E = IR + Ir$ or	voltage divided between R and r	C1	
		$I = 1.5 / 2.0$ (=0.75 A)	p.d. across R = p.d. Across r = 1.5	C1	
		$3.0 = 1.5 + 0.75r$			
		$r = 2.0\ \Omega$	so $R = r = 1.99\ \Omega$	A1	**[3]**
	(c)	larger p.d. across R means smaller p.d. across r		M1	
		smaller power dissipation at larger value of V		A1	
		since power is VI and I is same for R and r		A1	**[3]**
8	**(a)**	position shown as A = 227, Z = 91		B1	**[1]**
	(b)	Pu shown as A = 243, Z = 94		B1	
		D shown with $A = A_{Pu}$ and with $Z = (Z_{Pu} + 1)$		B1	**[2]**