## MARK SCHEME for the May/June 2013 series

## 9702 PHYSICS

9702/21

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, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2013 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.



	Page 2		Mark Scheme	Syllabus	Paper	,
			GCE AS/A LEVEL – May/June 2013	9702	21	
1	(a)		e returns to its original length (not 'shape') he load is removed		M1 A1	[2]
	(b)	energy	: N m / kg m <sup>2</sup> s <sup>-2</sup> and volume m <sup>3</sup> / volume: kg m <sup>2</sup> s <sup>-2</sup> / m <sup>3</sup> / volume: kg m <sup>-1</sup> s <sup>-2</sup>		C1 M1 A0	[2]
	(c)	<i>E</i> : kg n	has no units kg m s <sup>-2</sup> m <sup>-2</sup>			
		units o no unit	f RHS: kg m <sup>-1</sup> s <sup>-2</sup> = LHS units / satisfactory conclusion to s s	how C has	A1	[3]
2	(a)	mass is the property of a body resisting changes in motion / quantity of matter in a body / measure of inertia to changes in motion				
		-	is the force due to the gravitational field/force due to gravitational force	ity	B1	[2]
		Allow 1	/2 for 'mass is scalar weight is vector'			
	(b)	• •	row vertically down through O nsion forces in correct direction on rope		B1 B1	[2]
		(ii) 1.	weight = $mg = 4.9 \times 9.81$ (= 48.07) 69 sin $\theta = mg$ $\theta = 44.(1)^{\circ}$ scale drawing allow ± use of cos or tan 1/3 only	2°	C1 C1 A1	[3]
		2.	$T = 69 \cos \theta$ = 49.6 / 50 N scale drawing 50 ±2 (2	2/2) 50 ±4 (1/2	C1 ) A1	[2]
		ful	rrect answers obtained using scale diagram or triangle of I marks s in <b>1.</b> then sin in <b>2.</b> (2/2)	forces will score		
3	(a)	gain in	potential energy due to decrease in height (as P.E. = $mgh$ ) h kinetic energy due to increase in speed (as K.E. = $\frac{1}{2} mv^2$ ) cial case 'as PE decreases KE increases' (1/2)		(B1) (B1)	
		increas	e in thermal energy due to work done against air resistan P.E. equals gain in K.E. and thermal energy	се	(B1) (B1) max. 3	[3]

	Page 3		}	Mark Scheme	Syllabus	Paper	
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	(b)	(i)	kine	etic energy = $\frac{1}{2} mv^2$ = $\frac{1}{2} \times 0.150 \times (25)^2$ = 46.875 = 47 J		C1 C1 A1	[3]
		(ii)	1.	potential energy (= <i>mgh</i> ) = 0.150 × 9.81 × 21 loss = KE – <i>mgh</i> = 46.875 – (30.9) = 15.97 = 16 J		C1 C1 A1	[3]
			2.	work done = $16 \text{ J}$ work done = force × distance F = 16 / 21 = 0.76  N		C1 A1	[2]
4	(a)	pre	ssure	e = force / area (normal to force)		A1	[1]
	(b)	mo (for	lecul ce ex	es/atoms/particles in (constant) random/haphazard motic es have a <u>change</u> in momentum when they collide with <u>th</u> xerted on molecules) therefore force on the walls the to average force from many molecules/many collisions	<u>ne walls</u>	B1 M1 A1 A1	[4]
	(c)	elastic collision when <u>kinetic</u> energy conserved temperature constant for gas					[2]
5	(a)	coh pat	ieren h diff	overlap / meet / superpose loce / constant phase difference ( <i>not constant</i> $\lambda$ or frequer ference = 0, $\lambda$ , $2\lambda$ or phase difference = 0, $2\pi$ , $4\pi$ rection of polarisation/unpolarised	асу)	(B1) (B1 <b>)</b> (B1) (B1) max. 3	[3]
	(b)	f = λ =		∈ 10 <sup>9</sup> Hz 10 <sup>8</sup> / 12 × 10 <sup>9</sup> ( <i>any subject)</i>		C1 C1 M1 A0	[3]
	(c)	<u>sev</u> 5 m	<u>eral</u> naxim	m at P minima or maxima between O and P na / 6 minima between O and P xima / 6 minima including O and P		B1 B1 B1	[3]
	(d)	slits ( <i>r</i>	s put not ju	de narrower closer together <i>ist 'make slits smaller')</i> ting the slits M1 and explanation of axes of rotation A1		B1 B1	[2]

	Page 4		Mark Scheme	Syllabus	Paper	
			GCE AS/A LEVEL – May/June 2013	9702	21	
6	(a) (i)	che	mical to electrical		B1	[1]
	(ii)	elec	ctrical to thermal / heat or heat and light		B1	[1]
	(b) (i)	( <i>P</i> <sub>B</sub> :	=) $EI$ or $I^2(R_1 + R_2)$		A1	[1]
	(ii)	( <i>P</i> <sub>R</sub>	=) $I^2 R_1$		A1	[1]
			A or clear from the following equation $\frac{1}{2}$		B1	
	ratio	= I2	${}^{2}R_{1}/I^{2}R_{2} = \frac{\rho l/\pi d^{2}}{\rho(2l)/\pi(2d)^{2}}$ or $R_{1}$ has $8 \times$ resistance of $R_{2}$		C1	
			= 8  or  8:1		A1	[3]
	· · /		<i>R</i> or $E^2 / R$ the same) hence ratio is 1/8 or 1:8 = 0.125 (allow ecf from	om <b>(c)</b> )	C1 A1	[2]
7	• •		prity/most went straight through deviated by small angles		B1	
		-	mall proportion/a few were deviated by large angles Igles described as < 10° <u>and</u> large angles described as >	•90°	B1 B1	[3]
	mas	s <u>an</u>	the atom is empty space/nucleus very small compared w <u>nd</u> charge concentrated in (very small) nucleus inks made with statements in <b>(a)</b>	vith atom	B1 B1 B1	[3]