

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
GCE A/AS Level

**MARK SCHEME for the November 2005 question paper**

**9702 PHYSICS**

**9702/02**

**Paper 2**

**maximum raw mark 60**

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

The minimum marks in these components needed for various grades were previously published with these mark schemes, but are now instead included in the Report on the Examination for this session.

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Page 1	Mark Scheme	Syllabus	Paper
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1	(a)	(i)	force per unit area (ratio idea essential)	B1		
		(ii)	$\text{kg m}^{-1} \text{s}^{-2}$	B1	[2]	
	(b)		$\rho$ has base unit $\text{kg m}^{-3}$	B1		
			$g$ has base unit $\text{m s}^{-2}$	B1		
		$h\rho g$ has base unit $\text{m} \times \text{kg m}^{-3} \times \text{m s}^{-2}$	M1			
		same as pressure QED	A0	[3]		
2	(a)		point where whole weight of body (allow mass)	M1		
			may be <u>considered</u> to act (do not allow 'acts')	A1	[2]	
	(b)		when CG below pivot, weight acts through the pivot	B1		
			(so) weight has no turning effect about pivot	B1	[2]	
3	(a)		<u>change</u> in velocity/time (taken)	B1	[1]	
			velocity is a vector/velocity has magnitude & direction	B1		
	(b)		direction changing so must be accelerating	B1	[2]	
	(c)		<i>either</i> $6.1 \times \cos 35 = 4.99 \text{ N}$	<i>or</i> scale shown	B1	
			so no resultant vertical force	triangle of correct shape	B1	
			$6.1 \sin 35 = 3.5 \text{ N}$	resultant = $3.5 \pm 0.2 \text{ N}$	B1	
			horizontally	horizontal $\pm 3^\circ$	B1	[4]
			<i>allow answer based on centripetal force:</i>			
			resultant is centripetal force (which is horizontal)	(B1)		
		resultant is horizontal component of tension	(B1)			
		$6.1 \sin 35 = 3.5 \text{ N}$	(B1)			
		horizontally	(B1)			
4	(a)	(i)	use of tangent at time $t = 0$	B1		
			acceleration = $42 \pm 4 \text{ cm s}^{-2}$	A1	[2]	
		(ii)	use of area of loop	B1		
			distance = $0.031 \pm 0.001 \text{ m}$	B2	[3]	
			allow 1 mark if $0.031 \pm 0.002 \text{ m}$			
	(b)	(i)	$F = ma$	C1		
			= $0.93 \times 0.42$ {allow e.c.f. from (a)(i)}			
			= $0.39 \text{ N}$	A1	[2]	
		(ii)	force reduces to zero in first 0.3 s	B1		
	then increases again in next 0.3 s		M1			
		in the opposite direction	A1	[3]		

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5	(a)	similarity: e.g. same wavelength/frequency/period, constant phase difference	B1	
		difference: e.g. different amplitude/phase (do not allow a reference to phase for both similarity and difference)	B1	[2]
	(b)	constant phase difference so coherent	B1	[1]
	(c) (i)	$intensity \propto amplitude^2$	C1	
		$I \propto 3^2$ and $I_B \propto 2^2$ leading to	M1	
		$I_B = \frac{4}{9}I$	A0	[2]
	(ii)	resultant amplitude = $1.0 \times 10^{-4}$ cm	C1	
		resultant intensity = $\frac{1}{9}I$	A1	[2]
	(d) (i)	displacement = 0	B1	[1]
	(ii)	$x_A = -2.6 \times 10^{-4}$ cm and $x_B = +1.7 \times 10^{-4}$ cm allow $\pm 0.5 \times 10^{-4}$ cm) resultant displacement = $(-) 0.9 \times 10^{-4}$ cm	C1 A1	[2]
6	(a)	force must be upwards (on positive charge) so plate Y is positive	M1 A1	[2]
	(b) (i)	$E = V / d$ $= 630 / (0.75 \times 10^{-2})$ $= 8.4 \times 10^4 \text{ N C}^{-1}$	C1 A1	[2]
	(ii)	$qE = mg$ $q = (9.6 \times 10^{-15} \times 9.8) / (8.4 \times 10^4)$ $= 1.12 \times 10^{-18} \text{ C}$	C1 C1 A1	[3]
7	(a)	$either \quad V = E R_1 / (R_1 + R_2) \quad or \quad I = E / (R_1 + R_2)$ $= \frac{1800}{3000} \times 4.50$ $= 2.70 \text{ V}$	C1 M1 A0	[2]
		$V = \frac{1800}{3000} \times 4.50$ $= 2.70 \text{ V}$		
	(b) (i)	for a wire, $V = I \times (\rho L / A)$ $I, \rho$ and $A$ are constant so $V \propto L$	M1 A1 A0	[2]

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(ii) 1 2.70 V A1 [1]

2  $\frac{L}{100} = \frac{2.70}{4.50}$  C1

$L = 60.0$  cm A1 [2]

(iii) thermistor resistance decreases as temperature rises M1  
so QM is shorter A1 [2]

8 (a) product of force and distance M1  
moved in the direction of the force A1 [2]

(b) (i) falls from rest B1  
decreasing acceleration B1  
reaches a constant speed B1 [3]

(ii) straight line with negative gradient B1  
y-axis intercept above maximum  $E_K$  B1  
reasonable gradient (same magnitude as that for  $E_K$  initially) B1 [3]