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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International Examinations

1 **(a)** **(i)** force per unit area (ratio idea essential) B1

(ii) kg m^{-1} s^{-2} B1 **[2]**

(b) ρ has base unit kg m^{-3} B1
g has base unit m s^{-2} B1
$h\rho g$ has base unit m $\times$ kg m^{-3} $\times$ m s^{-2} M1
same as pressure QED A0 **[3]**

2 **(a)** point where whole weight of body (allow mass) M1
may be considered 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)** change in velocity/time (taken) B1 **[1]**

(b) velocity is a vector/velocity has magnitude & direction B1
direction changing so must be accelerating B1 **[2]**

(c)

either 6.1 $\times$ cos35 = 4.99 N	*or* scale shown	B1	
so no resultant vertical force	triangle of correct shape	B1	
6.1 sin35 = 3.5 N	resultant = 3.5 $\pm$ 0.2 N	B1	
horizontally	horizontal $\pm$ 3°	B1	**[4]**

allow answer based on centripetal force:
resultant is centripetal force (which is horizontal) (B1)
resultant is horizontal component of tension (B1)
6.1 sin35 = 3.5 N (B1)
horizontally (B1)

4 **(a)** **(i)** use of tangent at time t = 0 B1
acceleration = 42 $\pm$ 4 cm s^{-2} A1 **[2]**

(ii) use of area of loop B1
distance = 0.031 $\pm$ 0.001 m B2 **[3]**
allow 1 mark if 0.031 $\pm$ 0.002 m)

(b) **(i)** $F = ma$ C1
= 0.93 $\times$ 0.42 {allow e.c.f. from (a)(i)}
= 0.39 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]**

5 **(a)** similarity: e.g. same wavelength/frequency/period, constant phase difference B1

difference: e.g. different amplitude/phase B1 **[2]**
(do not allow a reference to phase for both similarity and difference)

(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 = 1.0×10^{-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 C1
allow $\pm 0.5 \times 10^{-4}$ cm)
resultant displacement = (-) 0.9×10^{-4} cm A1 **[2]**

6 **(a)** force must be upwards (on positive charge) M1
so plate Y is positive A1 **[2]**

(b) **(i)** $E = V / d$ C1
$= 630/(0.75 \times 10^{-2})$
$= 8.4 \times 10^4$ N C^{-1} A1 **[2]**

(ii) $qE = mg$ C1
$q = (9.6 \times 10^{-15} \times 9.8) / (8.4 \times 10^4)$ C1
$= 1.12 \times 10^{-18}$ C A1 **[3]**

7 **(a)** *either* $V = E R_1 / (R_1 + R_2)$ *or* $I = E / (R_1 + R_2)$ C1

$= \frac{1800}{3000} \times 4.50$ $V = \frac{1800}{3000} \times 4.50$ M1

$= 2.70$ V $= 2.70$ V A0 **[2]**

(b) **(i)** for a wire, $V = I \times (\rho L/A)$ M1
I, ρ *and* A are constant A1
so $V \propto L$ A0 **[2]**

	(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]**