

NOVEMBER 2001

ADVANCED SUBSIDIARY LEVEL

MARK SCHEME

MAXIMUM MARK : 50

SYLLABUS/COMPONENT : 8709/4

MATHEMATICS



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	AS Level Examinations – November 2001	8709	4

1		M1	For using $WD = Fd \cos \alpha$
	$WD = 30 \times 80 \cos 10^\circ$	A1	
	Answer: 2360J	A1	3
2	(i)	M1	For attempting to find the gradient of the relevant section
	$\frac{9500-1500}{440-120}$	A1	2
	Answer: 25ms^{-1}		
	(ii)	M1	For drawing 3 connected straight line segments with, in order, +ve, zero and -ve slopes
	Any two of the following three features:	A1	
	<i>Graph starts at the origin and terminates on the t-axis</i>		
	<i>The acceleration stage is less steep than the deceleration stage</i>		
	<i>25ms^{-1} (f.t. for ans (i)) is correctly shown</i>		
	All three of the above features	A1	3
3	$R = mg \cos 30^\circ$	B1	
	$F = 0.4 mg \cos 30^\circ$	M1	For using $F = \mu R$
	Component of the weight down the plane = $mg \sin 30^\circ$	M1	For resolving forces along the plane
	$0.4 mg \cos 30^\circ + P = mg \sin 30^\circ$	B1ft	f.t. for cos instead of sin, following earlier cos/sin mix
	Answer: $P = 0.768$	A1ft	Depends on both M marks; f.t. for wrong F or wrong weight component
		A1	6
4	(i)	M1	For using $s(t) = \int v dt$ and attempting to integrate
	$s = 2t^2 - 0.01t^4$	A1	
	$2t^2 - 0.01t^4 = 100$	B1ft	f.t. for wrong $s(t)$
	Answer: $t = 10$	M1	For identifying the equation as a quadratic in t^2 and attempting to solve
		A1	5
	(ii)	M1	For using $a = dv/dt$ and attempting to differentiate
	$4 - 0.12t^2$	A1	
	Answer: -ve when $t = 10 \rightarrow$ slowing down	A1	3
	Alternative for the above 3 marks:		
	$v(10) = 0 \rightarrow$ slowing down	B3	

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5	(i)	$T_{AR} = T_{BR}$	B1	1	
	(ii)	$T \cos RAB = T \cos RBA \rightarrow$ angle $RAB = \text{angle } RBA$	B1	1	
	(iii)	$2T \cos 60^\circ = 0.5g$	M1		For resolving forces on R vertically
		$T = 0.5g$	A1		May be implied
		$R = 0.3g + T \sin 30^\circ$	M1		For resolving the forces on B vertically (3 terms required)
		Answer: 5.5N	A1ft		f.t. for 3 + $\frac{1}{2}$ T
Alternative for the above 4 marks:					
		For using $R_B = R_A + 0.3g$	B1		
		For resolving forces vertically on the whole system ($R_B + R_A = (0.5 + 0.3)g$) or for $R_A = \frac{1}{2}(0.5g)$ and eliminating R_A	M1		
		Answer: 5.5 N	A1		
		$T = 0.5g$	B1		
		$F = T \cos 30^\circ$	M1		For resolving the forces on B horizontally
		Answer: 4.33N	A1	6	
6	(i)		M1		For applying N2 to one particle, or for using $(m_1 + m_2)a = (m_1 - m_2)g$
		$0.5a = 0.5g - T$ or $0.4a = T - 0.4g$ or $0.9a = 0.1g$	A1		
			M1		For applying N2 to the other particle (if necessary) and solving for a
		Answer: 1.11ms^{-2}	A1	4	
	(ii)	$v^2 = 2(g/9)4.5$	M1		For using $v^2 = 2as$
		$0 = g^{1/2} - gt$	M1		For using $0 = u + at$
		Answer: 0.316s	A1	3	
	(iii)		M1		For using distance is $2s$ and obtaining s from $(u + 0)/2 = st$, $0 = u^2 + 2as$ or $s = ut + \frac{1}{2}at^2$
		Answer: 1m	A1	2	

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7	(i)	1200g(500 sin6°) seen or implied	B1	Can be scored in 1 st or 2 nd part	
			M1	For using WD by driving force = PE gain + WD against resistance, or for using WD against resistance = (1800 – component of weight) × 500	
		1800 × 500 = 1200g(500 sin6°) + WD against resistance, or WD against resistance = (1800 – 1200gsin6°) × 500 Answer: 273 000J	A1ft	f.t. for wrong PE gain or equivalent	
			A1	4	
	(ii)		M1	For using KE gain = ½ m(v² – u²)	
		½ 1200(20² – 8²)	A1		
		WD = 201 600 + 627 170 + 700 × 500	M1	For using WD by driving force = KE gain + PE gain + WD against resistance	
		Answer: 1 180 000 J	A1	4	
	SR (For candidates who assume, implicitly or otherwise, that the acceleration is constant) (max 2 out of 4)				
	For finding the acceleration (0.336) using v² = u² + 2as, applying Newton's 2 nd law to find the force of D's engine (2360) and multiplying by 500 to find the WD. M1				
Answer: 1 180 000 J A1					
(iii)		M1	For using $\frac{P_{top}}{P_{bottom}} = \frac{F_{top}}{F_{bottom}} \times \frac{v_{top}}{v_{bottom}}$		
	Ratio = 4 × 20/8	A1			
	Answer: 10	A1	3		
SR (max 1 out of 3)					
For using calculated values of F in the ratio 4:1 (e.g. 2360 × 4 and 2360), and obtaining the answer 10:1 for required ratio. B1					