

**Mark Scheme 4729
June 2007**

1	$40 \cos 35^\circ$	B1	
	$WD = 40 \cos 35^\circ \times 100$	M1	
	3280 J	A1 3	ignore units 3

2	$0 = 12 \sin 27^\circ t - 4.9t^2$ any correct.	M1	or $R = u^2 \sin 2\theta / g$ (B2)
	$t = 1.11$method for total time	A1	correct formula only
	$R = 12 \cos 27^\circ \times t$	M1	$12^2 \times \sin 54^\circ / 9.8$ sub in values
	11.9	A1 4	11.9 4

3 (i)	$WD = \frac{1}{2} \times 250 \times 150^2 - \frac{1}{2} \times 250 \times 100^2$	M1	
	1 560 000	A1	1 562 500
	$450\,000 = 1\,560\,000/t$	M1	
	3.47	A1 4	
(ii)	$F = 450\,000/120$	M1	
	3750	A1	
	$3750 = 250a$	M1	
	15 ms^{-2}	A1 4	8

4 (i)	$x = 7t$	B1	
	$y = 21t - 4.9t^2$	M1	or $-g/2$
		A1	
	$y = 21 \cdot x/7 - 4.9 x^2/49$	M1	
	$y = 3x - x^2/10$	A1 5	AG
(ii)	$-25 = 3x - x^2/10$ (must be -25)	M1	or method for total time (5.26)
	solving quadratic	M1	or 7 x total time
	36.8 m	A1 3	8

5(i)	$\frac{1}{2} \cdot 70 \cdot 4^2$	M1	
	560 J	A1 2	
(ii)	$70 \times 9.8 \times 6$	M1	
	4120	A1 2	4116
(iii)	60d	B1	
	$8000 = 560 + 4120 + 60d$	M1	4 terms
		A1 ✓	✓ their KE and PE
	55.4 m	A1 4	8

6 (i)	$5\cos 30^\circ = 0.3 \times 9.8 + S\cos 60^\circ$	M1	res. vertically (3 parts with comps)
		A1	
	2.78 N	A1 3	
(ii)	$r = 0.4\sin 30^\circ = 0.2$	B1	may be on diagram
	$5\sin 30^\circ + S\sin 60^\circ = 0.3 \times 0.2 \times \omega^2$	M1	res. horizontally (3 parts with comps)
	9.04 rads^{-1}	A1 3	
(iii)	$v = 0.2 \times 9.04$	M1	or previous v via mv^2/r
	$\text{KE} = \frac{1}{2} \times 0.3 \times (0.2 \times 9.04)^2$	M1	
	0.491 J or 0.49	A1 ✓ 3	✓ their $\omega^2 \times 0.006$ 9

7 (i)	$1.8 = -0.3 + 3m$	M1	
	$m = 0.7$	A1 2	AG
(ii)	$e = 4/6$	M1	accept 2/6 for M1
	2/3	A1 2	accept 0.67
(iii)	$\pm 3f$	B1	
	$1/3 \text{ } \odot \text{ } f \text{ (} \ominus \text{ } 1 \text{)}$	B1 2	
(iv)	$I = 3f \times 0.7 - - 3 \times 0.7$	M1	ok for only one minus sign for M1
		A1	
	$I = 2.1 (f + 1)$	A1 3	aef 2 marks only for $-2.1(f + 1)$
(v)	$0.3 + 6.3/4 = 0.3a + 0.7b$	M1	can be $-0.7b$
	$3a + 7b = 18.75$	A1 *	aef
	$2/3 = (a - b)/ 5/4$	M1	allow $e=3/4$ or their e for M1
	$3a - 3b = 5/2$	A1 *	aef * means dependent.
	solve	M1	
	$a = 2.5$	A1	(2.46) allow $\pm (59/24)$
	$b = 1.6$	A1 7	(1.625) allow $\pm (13/8)$ 16

8 (i)	com of hemisphere 0.3 from O	B1	or 0.5 from base
	com of cylinder $h/2$ from O	B1	
	$0.6 \times 45 = 40 \times 0.5 + (0.8 + h/2) \times 5$ or	M1	or $40 \times 0.3 - 5xh/2 = 45 \times 0.2$
	$45(h+0.2) = 5h/2 + 40(h+0.3)$	A1	or $5(0.2 + h/2) = 40 \times 0.1$
	$27 = 20 + (0.8 + h/2) \times 5$	M1	solving
	$h = 1.2$	A1 6	AG
(ii)	1.2 T	B1	
	0.8 F	B1	
	$0.8F = 1.2T$	M1	
	$F = 3T/2$	A1 4	aef
(iii)	$F + T\cos 30^\circ$	B1	or $45 \times 0.8 \sin 30^\circ$
	45 $\sin 30^\circ$ must be involved in res.	B1	$T \times (1.2 + 0.8\cos 30^\circ)$
	resolving parallel to the slope	M1	mom. about point of contact
	$F + T\cos 30^\circ = 45\sin 30^\circ$ aef	A1	$45 \cdot 0.8 \sin 30^\circ = T(1.2 + 0.8\cos 30^\circ)$
	$T = 9.51$	A1	
	$F = 14.3$	A1 6	16
or	$T + F\cos 30^\circ = R\sin 30^\circ$	B1	res. horizontally
(iii)	$R\cos 30^\circ + F\sin 30^\circ = 45$	B1	res. vertically
	$\tan 30^\circ = (T + F\cos 30^\circ) / (45 - F\sin 30^\circ)$	M1	eliminating R