

4729 Mechanics 2

1	$75 \times 9.8 \times 40$ $(75 \times 9.8 \times 40) \div 120$ 245 W	B1 M1 A1 [3]	Average Speed = $40 \div 120$ $(75 \times 9.8) \times (\text{Average speed})$	3
2 (i)	$v^2 = 2 \times 9.8 \times 3$ or $2 \times 9.8 \times 1.8$ $v_1 = \sqrt{6g}$ or $\sqrt{58.8}$ or $\frac{7}{5}\sqrt{30}$ or 7.67 $v_2 = \sqrt{3.6g}$ or $\sqrt{35.28}$ or $\frac{21}{5}\sqrt{2}$ or 5.94 $I = \pm 0.2(5.94 + 7.67)$ 2.72	M1 A1 A1 M1 A1ft [5]	Kinematics or energy Speed of impact ($\pm$) Speed of rebound ($\pm$) +ve, ft on v_1 and v_2	
(ii)	$e = 5.94/7.67$ 0.775 or $\frac{\sqrt{15}}{5}$	M1 A1ft [2]	Allow 0.774, ft on v_1 and v_2	7
3 (i)	$\bar{u} = 0.2$ (from vertex) or 0.8 or 0.1 $0.5\bar{d} = 0.2 \times \bar{u} + 0.3 \times 0.65$ $\bar{d} = 0.47$	B1 M1 A1 A1 [4]	com of conical shell AG	
(ii)	$s = 0.5$ $T \sin 80^\circ \times 0.5 = 0.47 \times 0.5 \times 9.8$ $T = 4.68 \text{ N}$	B1 M1 A1 A1 [4]	slant height, may be implied	8
4 (i)	$D - 400 = 700 \times 0.5$ $D = 750 \text{ N}$	M1 A1 [2]	3 terms	
(ii)	$P = 750 \times 12$ 9 000 W or 9 kW	M1 A1ft [2]		
(iii)	$P/35 = 400$ 14 000 W or 14 kW	M1 A1 [2]		
(iv)	$D = 14000/12$ $3500/3 = 400 + 700 \times 9.8 \sin \theta$ $\theta = 6.42^\circ$	B1ft M1 A1 A1 [4]	May be implied 3 terms Their P/12	10

(iii)	$\varphi = 26.6^\circ$ or $\sin \varphi = \frac{1}{\sqrt{5}}$ or $\cos \varphi = \frac{2}{\sqrt{5}}$ or	B1	$\varphi =$ angle to horizontal
	$\tan \varphi = 0.5$	B1	
	$T = 0.98$ or $0.1g$	M1	Vertically, 3 terms
	$N \cos \theta = T \sin \varphi + 0.2 \times 9.8$	A1	
	$N \times 3/5 = 0.438 + 1.96$	A1	
	$N = 4.00$	A1	may be implied
	$N \sin \theta + T \cos \varphi = 0.2 \times 4 \times \omega^2$	M1	Horizontally, 3 terms
	$4 \times 4/5 + 0.98 \cos 26.6^\circ = 0.8 \omega^2$ $\omega = 2.26 \text{ rad s}^{-1}$	A1	

[8]**15**