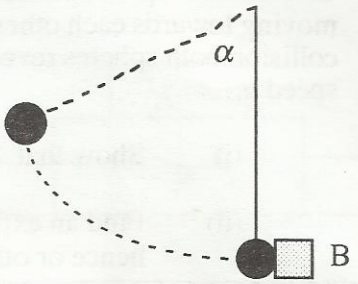
1998

5 (b) A sphere of mass 4 kg is released from rest when $\alpha = 60°$. It swings down and strikes a 7 kg box B when the string is vertical. The distance from the point of support to the centre of the sphere is one metre and the coefficient of restitution for the collision is $\frac{3}{4}$.

Calculate the speed of the box immediately after the impact if the box is free to move.



Gain in K.E. = Loss in P.E.

$\frac{1}{2}(4)v^2 = 4g(1 - 1.\cos 60)$

$\Rightarrow \quad v = \sqrt{g}$

mass	velocity before	velocity after
4	$\sqrt{g}$	v_1
7	0	v_2

P.C.M. $\quad 4\sqrt{g} + 0 = 4v_1 + 7v_2$

N.E.L. $\quad v_1 - v_2 = -\frac{3}{4}(\sqrt{g} - 0)$

$4v_1 + 7v_2 = 4\sqrt{g}$

$4v_1 - 4v_2 = -3\sqrt{g}$

$\Rightarrow \quad v_2 = \frac{7\sqrt{g}}{11}$ or 1.99

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