1984 P4

(3) (4)

$u_1 = v_1$ $u_2 = v_2$

P.C.M : $\Rightarrow$ $3u_1 + 4u_2 = 3v_1 + 4v_2$.

Newt. $\Rightarrow$ $v_2 - v_1 = -e(u_2 - u_1)$

$\Rightarrow$ $-4eu_2 + 4eu_1 = 4v_2 - 4v_1$

Subtract to elim v_2 [As there is no v_2 in the answer].

$\therefore (3 - 4e)u_1 + 4(1+e)u_2 = 7v_1$. qed

Impulse = Δp on 3 kg

$= 3v_1 - 3u_1$

$= \frac{3}{7}[(3-4e)u_1 + 4(1+e)u_2] - 3u_1$

$= \frac{9}{7}u_1 - \frac{12}{7}eu_1 + \frac{12}{7}u_2 + \frac{12}{7}eu_2 - \frac{21}{7}u_1$

$= -\frac{12}{7}u_1 - \frac{12}{7}eu_1 + \frac{12}{7}u_2 + \frac{12}{7}eu_2 - \frac{21}{7}u_1$

$= -\frac{12}{7}u_1 - \frac{12}{7}eu_1 + \frac{12}{7}u_2 + \frac{12}{7}eu_2$

$= -\frac{12}{7}u_1(1+e) + \frac{12}{7}u_2(1+e)$

$= \frac{12}{7}(1+e)(u_2 - u_1)$ qed

$\vec{v_1} = 0\vec{i} + v\vec{j}$ $\vec{v_2} = x\vec{i} + 0\vec{j}$

$\vec{u_1} = a\vec{i} + b\vec{j}$ $\vec{u_2} = 0\vec{i} + 0\vec{j}$.

* (B) $e = \frac{4}{7}$ (4) (m)

$e = \frac{4}{7}$ Smooth $\Rightarrow$ cpts $\perp$ L remains unchanged. (5)

$\Rightarrow$ Second mass always moves along L.

$\therefore$ Given that each of sphere move $\perp$ to each other 4 kg mass moves $\perp$ to L. (10)

P.C.M [$\vec{i}$] $4a + m.0 = 4.0 + mx \Rightarrow 4a = mx$ (1) (4)

NLR [$\vec{i}$]. $v_2 - 0 = -\frac{4}{7}(0 - u_1) \Rightarrow 4a = 7x$ (2) (4)

(1) and (2) $\Rightarrow$ $m = 7$ kg

(3)