5 PCM $mu + 0 = mv_1 + mv_2 \Rightarrow v_1 + v_2 = u$

NEL $v_1 - v_2 = -e(u - 0) \Rightarrow v_1 - v_2 = -eu$

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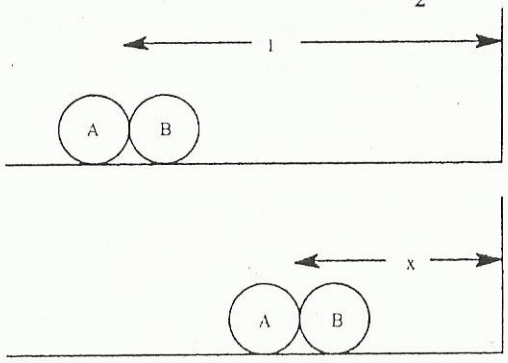
$v_1 = \frac{u}{2}(1 - e)$

$v_2 = \frac{u}{2}(1 + e)$



B strikes the wall with velocity $\frac{u}{2}(1 + e)$ and rebounds with velocity $\frac{eu}{2}(1 + e)$

$$\frac{l - x}{\frac{u}{2}(1 - e)} = \frac{l}{\frac{u}{2}(1 + e)} + \frac{x}{\frac{eu}{2}(1 + e)}$$

$$x = \frac{2e^2}{1 + e^2}$$

OR

Time for B to reach the wall $= \frac{\text{distance}}{\text{speed}} = \frac{l}{\frac{u}{2}(1 + e)} = \frac{2}{u(1 + e)}$

In this time A travels $\frac{u}{2}(1 - e)\frac{2}{u(1 + e)} = \frac{1 - e}{1 + e}$

and is now $1 - \frac{1 - e}{1 + e} = \frac{2e}{1 + e}$ from the wall

B's rebound velocity is $\frac{eu}{2}(1 + e)$

$$\frac{x}{\frac{eu}{2}(1 + e)} = \frac{\frac{2e}{1 + e} - x}{\frac{u}{2}(1 - e)}$$

$$x = \frac{2e^2}{1 + e^2}$$

1 6 NOR E

6 (i) amplitude $= (1.5 - 0.9) \div 2 = 0.3$ metres

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Period $= \frac{2\pi}{\omega} = \frac{\pi}{6} \Rightarrow \omega = 12$ rad/s

max speed $= \omega a = 12 \times 0.3 = 3.6$ m/s

(ii) Maximum force that the glue has to exert is at the **highest point**, when

maximum acceleration $= \omega^2 a$

$= 144 \times 0.3$

$= 43.2$ (downwards)

Let F be the force that the glue exerts on Q

Force = mass x acceleration

$mg + F = mf$

$0.2(9.8) + F = 0.2(43.2)$

$F = 6.68$ N

(iii) In the absence of glue, Q will leave the pan when $R = 0$

$mg - R = mf$

$mg - 0 = m\omega^2 x$

$9.8 = 144x$

$x = 0.068$ m

$\Rightarrow$ length of spring $= 1.2 - 0.068 = 1.132$ m