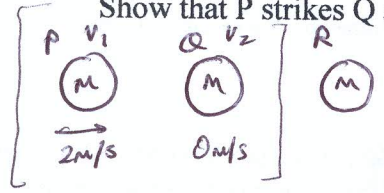let mass = M   initial vel = 0

5. (a) Three **identical** smooth spheres P, Q and R, <u>lie at rest</u> on a smooth horizontal table with their centres in a straight line. Q is between P and R.
Sphere P is projected towards Q with speed 2 m/s. Sphere P collides directly with Q and then Q collides directly with R.

The coefficient of restitution for all of the collisions is $\dfrac{3}{4}$. $e = \frac{3}{4}$

Show that P strikes Q a second time.
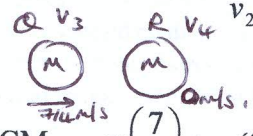

| PQ | PCM | $m(2) + m(0) = mv_1 + mv_2$ ① | 5 |

①÷M $v_1 + v_2 = 2$ NEL $v_1 - v_2 = -\dfrac{3}{4}(2-0)$ ②

② $v_1 - v_2 = -\dfrac{3}{2}$

$2v_1 = \dfrac{1}{2}$

$v_1 = \dfrac{1}{4}$

Subs into ①

$v_2 = 2 - \dfrac{1}{4}$

$v_2 = \dfrac{7}{4}$

$v_1 = \dfrac{1}{4}$

$v_2 = \dfrac{7}{4}$

5

| QR | PCM | $m\left(\dfrac{7}{4}\right) + m(0) = mv_3 + mv_4$ ① | 5 |

①÷M: $\dfrac{7}{4} = v_3 + v_4$

② $\dfrac{-21}{16} = v_3 - v_4$

$\dfrac{28 - 21}{16} = 2v_3$

$\dfrac{7}{16} = 2v_3$

$\dfrac{7}{32} = v_3$

NEL $v_3 - v_4 = -\dfrac{3}{4}\left(\dfrac{7}{4} - 0\right)$ ②

$v_3 = \dfrac{7}{32}$

Sub into ①

$\dfrac{7}{4} = \dfrac{7}{32} + v_4$

$\dfrac{56 - 7}{32} = v_4$

$\dfrac{49}{32} = v_4$

speed of P > speed of Q

As $\dfrac{1}{4} > \dfrac{7}{32}$ P strikes Q a second time

5

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