1700 w.

1988

Collision 1 A/B

$v_1 = ?$ $v_2 = ?$

④ ⑧ $e = \frac{1}{4}$

$u_1 = u$ $u_2 = 0$

PCM $\Rightarrow$

$4u + 0 = 4v_1 + 8v_2$

$\boxed{u = v_1 + 2v_2}$ ①

NLR $\Rightarrow$

$v_2 - v_1 = -\frac{1}{4}(0 - u)$

$\Rightarrow \boxed{4v_2 - 4v_1 = u}$ ②

Solve ① and ② for v_1 and v_2 in terms of u

① $\times 4 \Rightarrow 4v_1 + 8v_2 = 4u$

$-4v_1 + 4v_2 = u$

$12v_2 = 5u$

$\Rightarrow \boxed{v_2 = \frac{5u}{12}}$

$\therefore u = v_1 + 2\left(\frac{5u}{12}\right)$

$\Rightarrow \frac{12u}{12} = v_1 + \frac{10u}{12}$

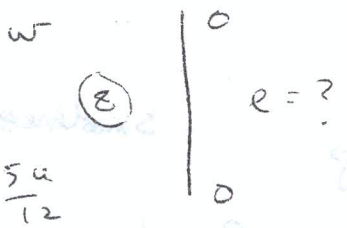
$\frac{2u}{12} = v_1$

$\boxed{\frac{u}{6} = v_1}$

$\therefore$ A travels towards wall with speed $\frac{u}{6}$

B travels towards wall with speed $\frac{5u}{12}$

Collision 2 B/Wall



NLR $\Rightarrow$

$w - 0 = -e\left(\frac{5u}{12} - 0\right)$

$\Rightarrow w = -\frac{5eu}{12}$

To follow this solution (!) read as follows: Collision 1 then collision 2 then collision 3 then answers to (ii) then to (i) and then to (iii).

Collision 3 A/B again

$v_1 = d$ $v_2 = 0$

④ ⑧ $e = \frac{1}{4}$

$u_1 = \frac{u}{6}$ $u_2 = -\frac{5}{12}ue$

PCM $\Rightarrow$

$4\left(\frac{1}{6}u\right) + 8\left(\frac{-5ue}{12}\right) = 4d + 0$

$\Rightarrow \frac{1}{6}u - \frac{10}{12}ue = d$

$\Rightarrow \boxed{u - 5ue = 6d}$ ③

NLR $\Rightarrow$

$0 - d = -\frac{1}{4}\left(\frac{-5ue}{12} - \frac{1}{6}u\right)$

$\Rightarrow 4d = \frac{-5ue}{12} - \frac{1}{6}u$

$\Rightarrow \boxed{48d = -5ue - 2u}$ ④

we answered (ii) first.!

Find d: ③ $\Rightarrow u - 5ue = 6d$

④ $\Rightarrow 2u + 5ue = -48d$

Add $3u = -42d$

$\Rightarrow \boxed{\frac{-u}{14} = d}$

velocity of A after all collisions is $-\frac{u}{14}\vec{i}$.

Answer (i)

③ $\Rightarrow u - 5ue = 6\left(\frac{-u}{14}\right)$

$\Rightarrow 1 - 5e = -\frac{3}{7}$

$\Rightarrow -5e = -\frac{10}{7}$

$\Rightarrow \boxed{e = \frac{2}{7}}$

Answer (iii)

KE Before all collisions $= \frac{1}{2}4u^2 + \frac{1}{2}8(0)^2 = 2u^2$ (④ ⑧)

KE after all collisions $= \frac{1}{2}4d^2 + \frac{1}{2}80^2$

$= 2d^2$

$= 2\left(\frac{u}{14}\right)^2 = \frac{u^2}{98}$

$\Rightarrow \Delta KE = 2u^2 - \frac{u^2}{98} = u^2\left[\frac{196}{98} - \frac{1}{98}\right] = u^2\frac{195}{98}$