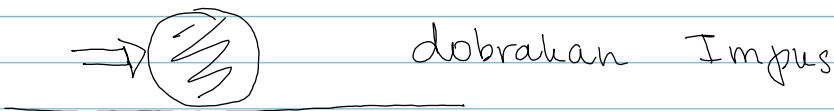
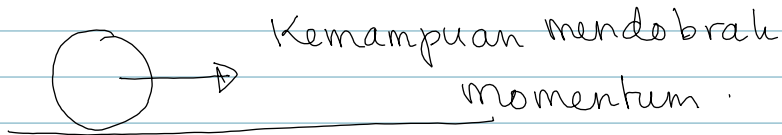
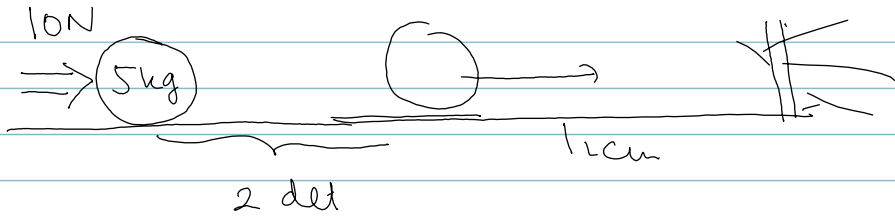


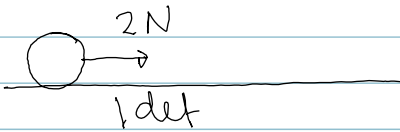
Dobrokan (Impuls) & Kemampuan mendorong (momentum)



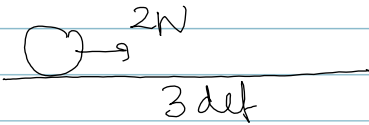
Satuan dobrokan = sd

1 sd → dobrokan yang diberikan oleh gaya 1 N selama 1 det

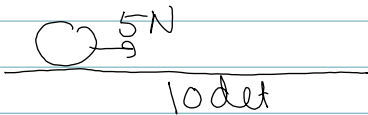
Dobrahan



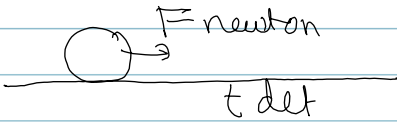
$$\text{Dobrahan} = 2 \cdot 1 = 2 \text{ sd}$$
$$I = 2 \text{ sd}$$



$$I = \text{Dobrahan} = 2 \cdot 3$$
$$= 6 \text{ sd}$$



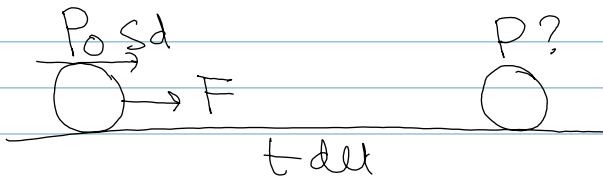
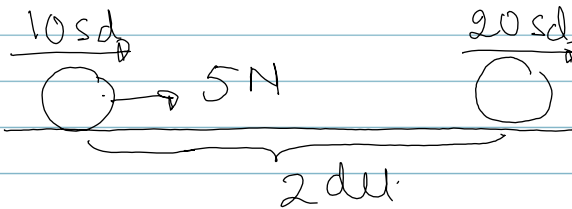
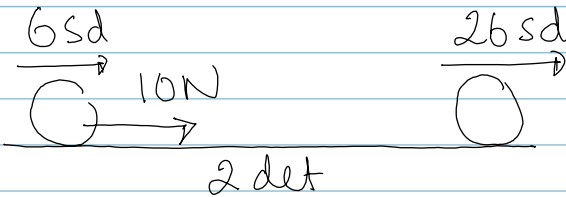
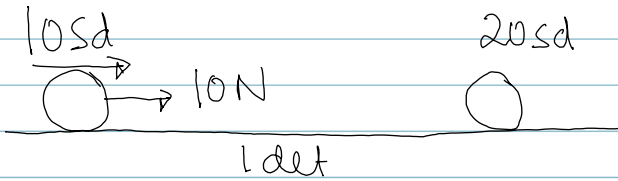
$$I = \text{Dobrahan} = 5 \cdot 10$$
$$= 50 \text{ sd}$$



$$I = F \cdot t \text{ sd}$$

$$I = F \cdot t \text{ Impuls (dobrahan)}$$

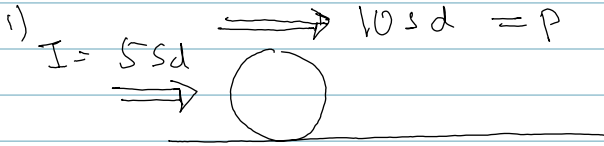
Kemampuan mendobrak dan dobrakan



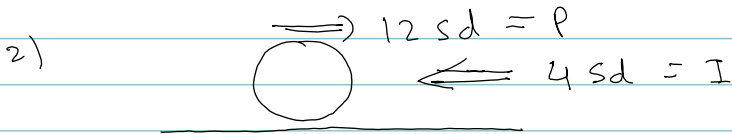
$$P = P_0 + F \cdot t$$



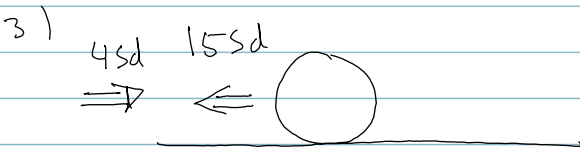
momentum (kemampuan mendobrak)



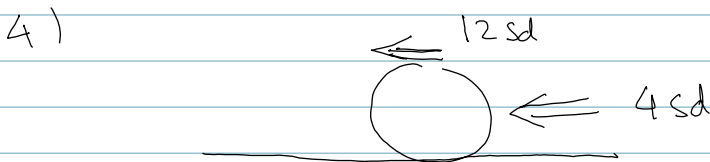
$$P' = P + I = 10 + 5 = \underline{\underline{15sd}} \text{ (kekanan)}$$



$$P' = 12 - 4 = 8sd \text{ (kekanan)}$$

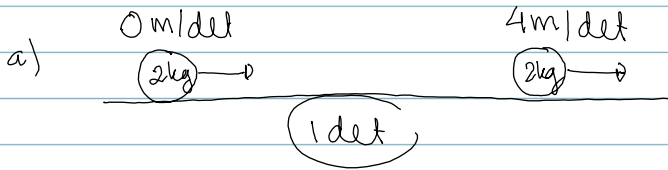


$$P' = 15 - 4 = 11sd \text{ (kekiri)}$$



$$P' = 12 + 4 = \underline{\underline{16sd}} \text{ (kekiri)}$$

Menghitung kemampuan mendobrak



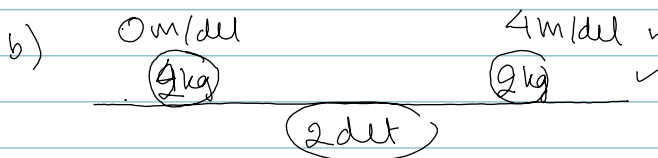
perubahan ke 4m/det dlm waktu 1det

$$a = 4\text{m/det}^2$$

$$F = 2 \times 4 = 8\text{N}$$

$$I = 8 \times 1 = 8\text{sd (dobrakan)}$$

$$P = \underline{\underline{8\text{sd}}} \text{ (kemampuan mendobrak)}$$

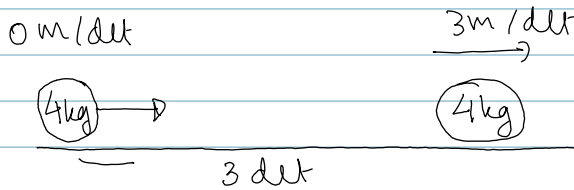


$$a = 2\text{m/det}^2$$

$$F = 2 \times 2 = 4\text{N}$$

$$I = 4 \times 2 = 8\text{sd}$$

$$P = \underline{\underline{8\text{sd}}}$$



$$a = 1 \text{ m/det}^2$$

$$F = 4 \times 1 = 4 \text{ N}$$

$$I = 4 \times 3 = 12 \text{ sd}$$

$$P = \underline{\underline{12 \text{ sd}}}$$



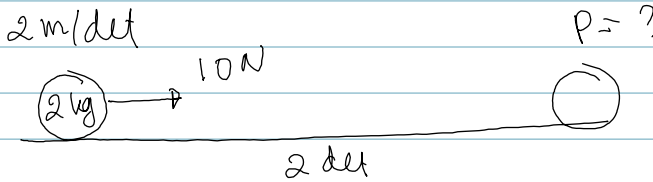
$$a = \frac{v}{t} \text{ m/det}^2$$

$$F = m \cdot \frac{v}{t} \text{ newton}$$

$$I = m \frac{v}{t} \cdot t = m v \text{ sd}$$

$$\boxed{P = m v} \quad \text{kg m/det}$$

$$\boxed{1 \text{ sd} = 1 \text{ kg m/det}}$$

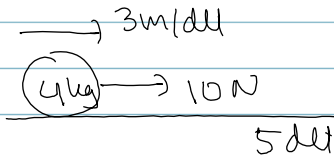


Cara I

$$P_0 = mV_0$$
$$= 2 \cdot 2 = 4 \text{ sd}$$
$$I = 10 \cdot 2 = 20 \text{ sd}$$
$$P = 4 + 20 = \underline{\underline{24 \text{ sd}}}$$

Cara II

$$a = \frac{10}{2} = 5 \text{ m/det}^2$$
$$V = 2 + 10 = \underline{\underline{12 \text{ m/det}}}$$
$$P = mV = 2 \cdot 12$$
$$= \underline{\underline{24 \text{ sd}}}$$



Cara I

$$P_0 = mV_0 = 4 \cdot 3 = 12 \text{ sd}$$
$$I = 10 \times 5 = 50 \text{ sd}$$
$$P = 12 + 50 = \underline{\underline{62 \text{ sd}}}$$

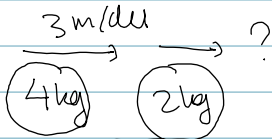
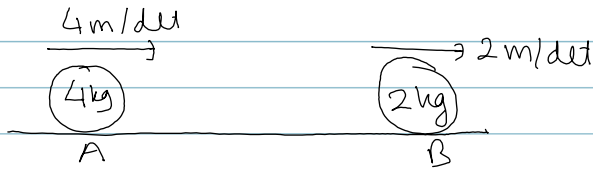
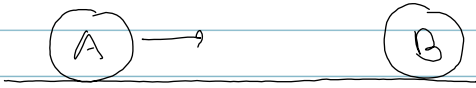
Cara II

$$a = \frac{10}{4} = 2,5 \text{ m/det}^2$$
$$V = 3 + 2,5 \cdot 5$$
$$= 15,5 \text{ m/det}$$
$$P = m \cdot V = 4 \cdot 15,5$$
$$= \underline{\underline{62 \text{ sd}}}$$

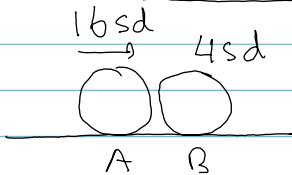


Tumbukan

1)

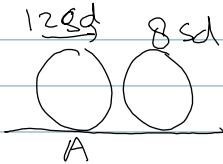


Energi hilang ?



B memberi dorakan (kekiri)

$$16 - 12 = \underline{4 \text{ sd}}$$



A memberi dorakan (kekanan)

$$4 \text{ sd}$$

Kemampuan mendobrak B = 8 sd

$$v_B = \underline{4 \text{ m/det}}$$

$$E_A = \frac{1}{2} m v^2 = \frac{1}{2} \cdot 4 \cdot 4^2 = 32 \text{ J}$$

$$E_B = \frac{1}{2} m v^2 = \frac{1}{2} \cdot 2 \cdot 2^2 = 4 \text{ J}$$

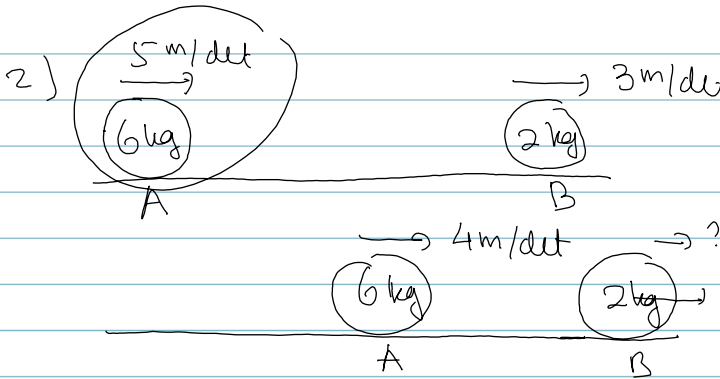
$$E_A' = \frac{1}{2} m v^2 = \frac{1}{2} \cdot 4 \cdot 3^2 = 18 \text{ J}$$

$$E_B' = \frac{1}{2} m v^2 = \frac{1}{2} \cdot 2 \cdot 4^2 = 16 \text{ J}$$

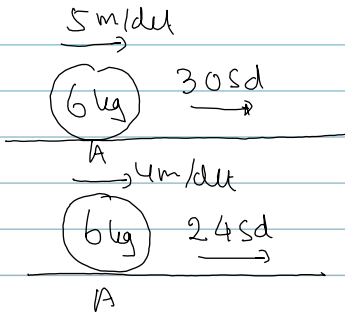
$$36 \text{ J}$$

$$34 \text{ J}$$

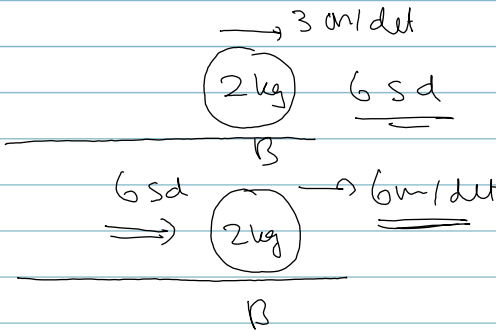
$$E_{\text{hilang}} = \underline{2 \text{ J}}$$



Energy ?



ada dobrakan keluri dari B
 $30 - 24 = \underline{\underline{6 \text{ s d}}}$

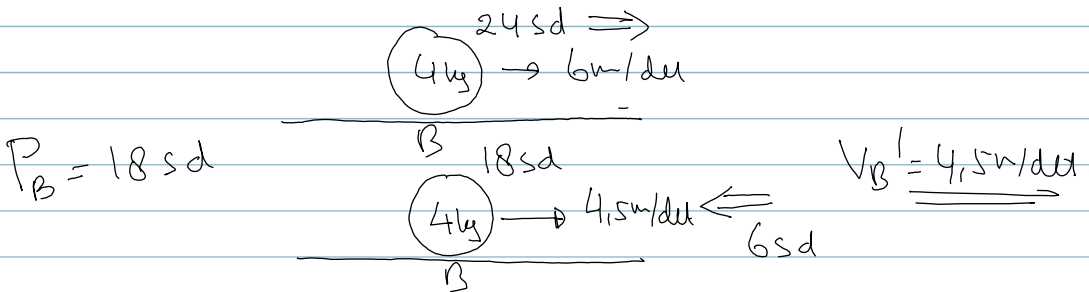
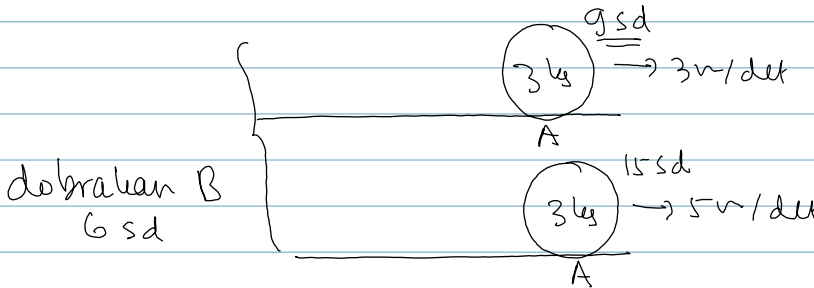
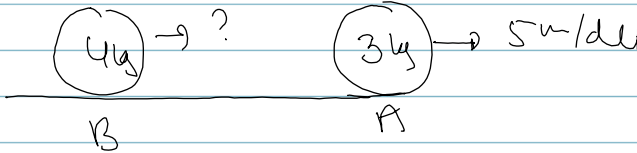
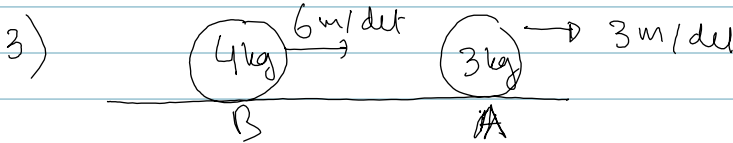


$$V_B' = 6 \text{ m/det}$$

$$\left. \begin{aligned} E_A &= \frac{1}{2} m_A v_A^2 = \frac{1}{2} \cdot 6 \cdot 5^2 = 75 \text{ J} \\ E_B &= \frac{1}{2} m_B v_B^2 = \frac{1}{2} \cdot 2 \cdot 3^2 = 9 \text{ J} \end{aligned} \right\} 84 \text{ J}$$

$$\left. \begin{aligned} E_A' &= \frac{1}{2} m_A v_A'^2 = \frac{1}{2} \cdot 6 \cdot 4^2 = 48 \text{ J} \\ E_B' &= \frac{1}{2} m_B v_B'^2 = \frac{1}{2} \cdot 2 \cdot 6^2 = 36 \text{ J} \end{aligned} \right\} 84 \text{ J}$$

tumbukan lenting sempurna

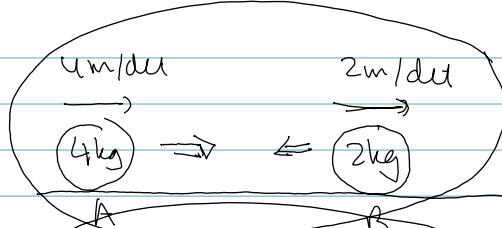


$$\left. \begin{aligned} E_A &= \frac{1}{2} m_A v_A^2 = \frac{1}{2} \cdot 3 \cdot 3^2 = 13,5 \text{ J} \\ E_B &= \frac{1}{2} m_B v_B^2 = \frac{1}{2} \cdot 4 \cdot 6^2 = 72 \text{ J} \end{aligned} \right\} 85,5 \text{ J}$$

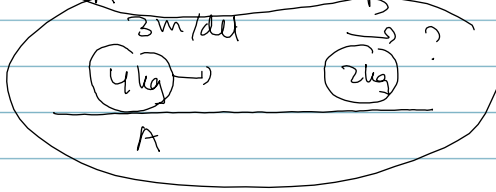
$$\left. \begin{aligned} E_A^1 &= \frac{1}{2} m_A v_A^{12} = \frac{1}{2} \cdot 3 \cdot 5^2 = 37,5 \text{ J} \\ E_B^1 &= \frac{1}{2} m_B v_B^{12} = \frac{1}{2} \cdot 4 \cdot 4,5^2 = 40,5 \text{ J} \end{aligned} \right\} 78 \text{ J}$$

Energy yang hilang (tidak elastik)

5) a)



$$P = 16 + 4 = 20 \text{ sd}$$

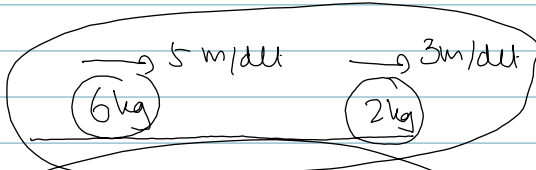


$$P' = 12 + 2V$$

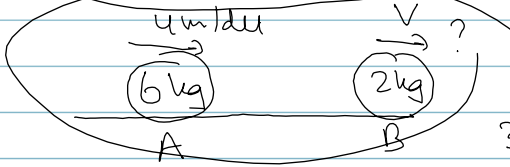
$$20 = 12 + 2V$$

$$8 = 2V \rightarrow V = \underline{\underline{4 \text{ m/d}}}$$

b)



$$P = 30 + 6 = 36 \text{ sd}$$

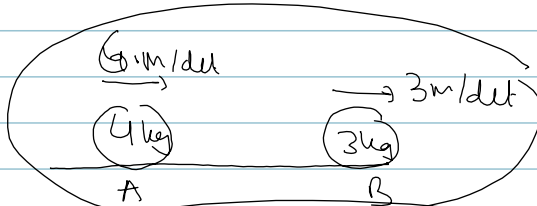


$$P' = 24 + 2V$$

$$36 = 24 + 2V$$

$$12 = 2V \rightarrow V = \underline{\underline{6 \text{ m/det}}}$$

c)



$$P = 24 + 9 = 33 \text{ s}$$

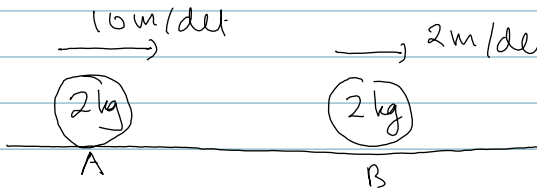


$$P' = 4V + 15$$

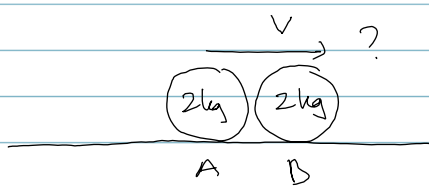
$$33 = 4V + 15$$

$$4V = 18 \rightarrow V = \underline{\underline{4,5 \text{ m/d}}}$$

5)



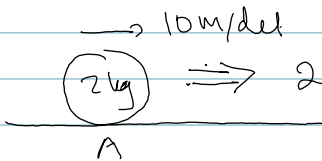
$$P = 20 + 4 = 24 \text{ s}$$



$$P' = 4V$$

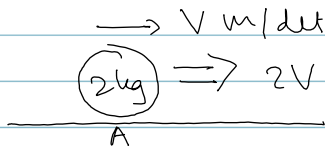
$$24 = 4V$$

$$V = \underline{\underline{6 \text{ m/det}}}$$



$$\Rightarrow 20 \text{ s d}$$

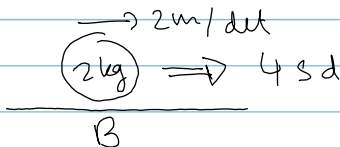
$$P_A = 20 \text{ s d}$$



$$\Rightarrow 2V$$

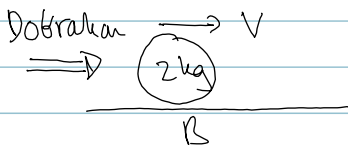
$$P_A' = 2V$$

$$\text{Dobrahan B} = 20 - 2V$$



$$\Rightarrow 4 \text{ s d}$$

$$P_B = 4 \text{ s d}$$



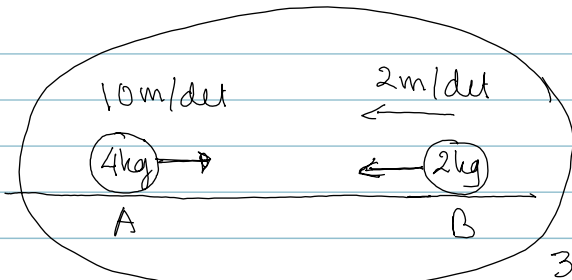
$$P_B' = 2V$$

$$\text{Dobrahan A} = (2V - 4) \text{ s d}$$

$$20 - 2V = 2V - 4$$

$$24 = 4V \rightarrow V = \underline{\underline{6 \text{ m/det}}}$$

6)

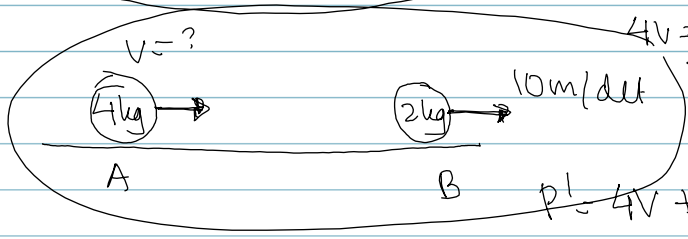


$$P = 40 - 4 = 36 \text{ sd}$$

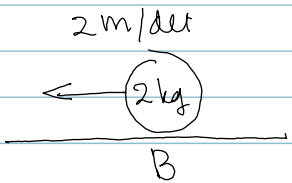
$$36 = 4V + 20$$

$$4V = 16$$

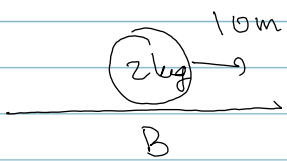
$$V = 4 \text{ m/d}$$



$$P' = 4V + 20$$

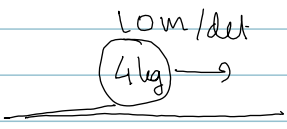


$$P_B = 4 \text{ sd (kekiri)}$$



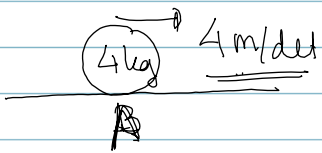
$$P'_B = 20 \text{ sd (kekanan)}$$

$$I_A = 24 \text{ sd (kekanan)}$$



$$I_B = 24 \text{ sd (kekiri)}$$

$$P_A = 40 \text{ sd (kekanan)}$$

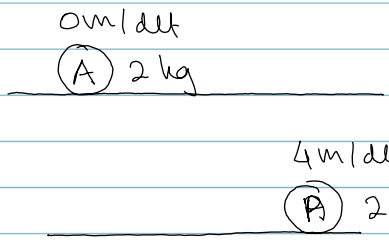


$$P_{A'} = 16 \text{ sd (kekanan)}$$

$$V_{A'} = 4 \text{ m/det}$$

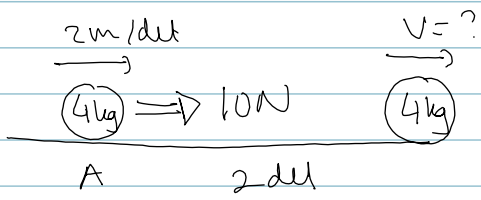
Latihan

1)



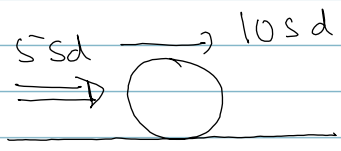
$$P_A = ?$$
$$P_A' = ?$$
$$I = ?$$

2)



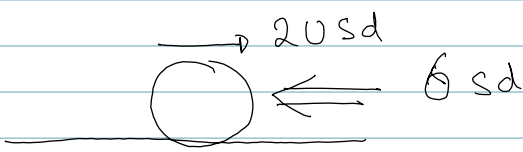
$$P_A = ?$$
$$I = ?$$
$$P_A' = ?$$
$$V = ?$$

3)



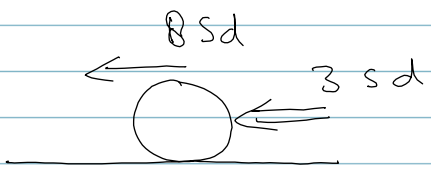
$$P' = ?$$

4)



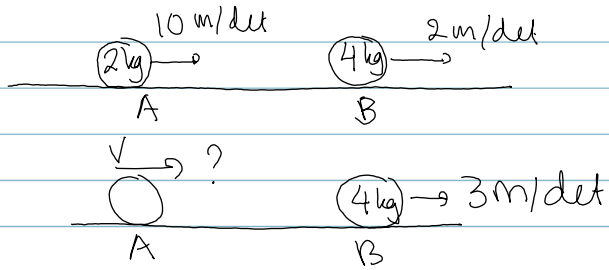
$$p' = ?$$

5)

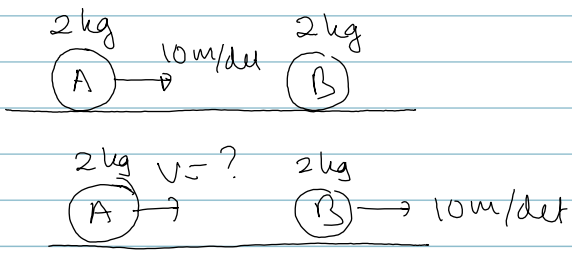


$$p' = ?$$

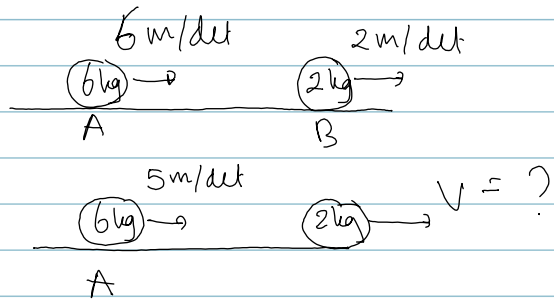
6)



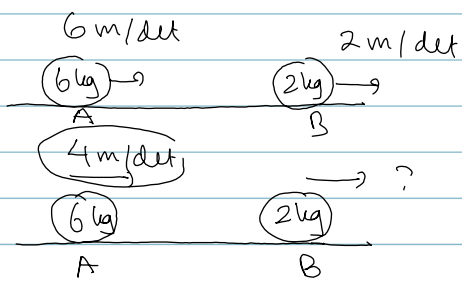
7)



8)

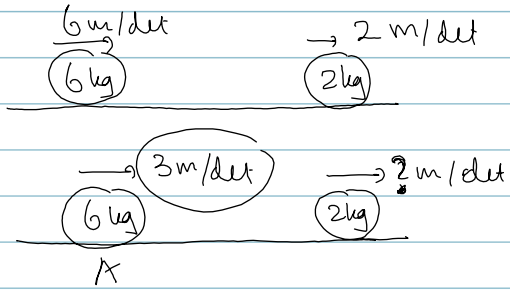


9)



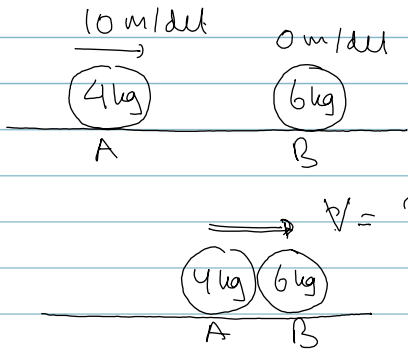
Energi yang hilang

10)

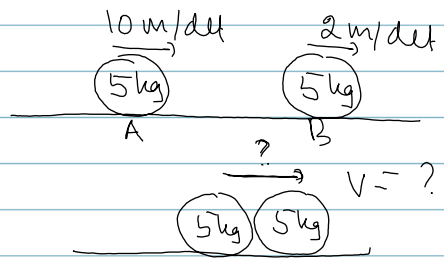


Energi yang hilang ??

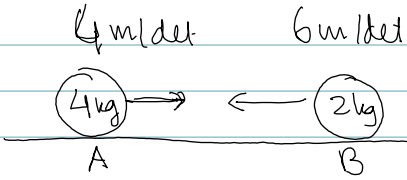
11)



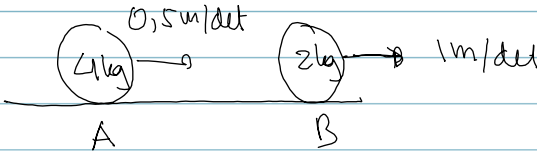
12)



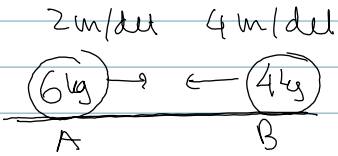
13)



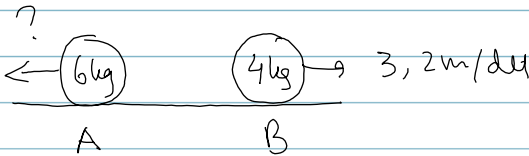
?



14)



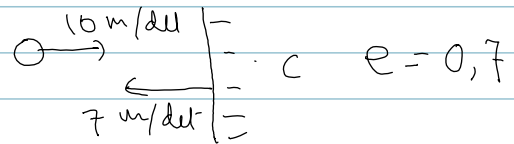
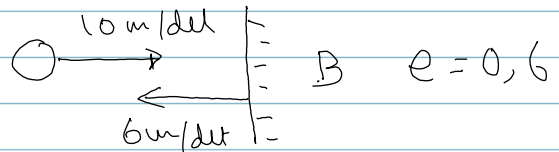
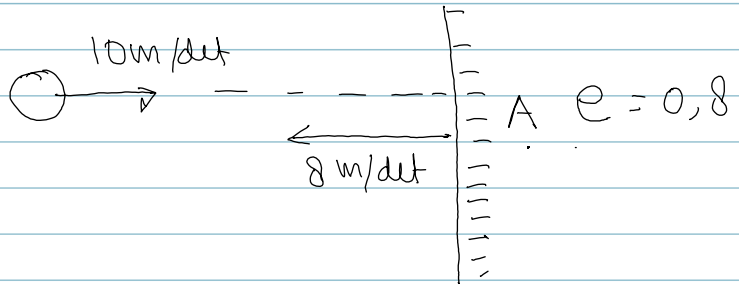
?





_____ e

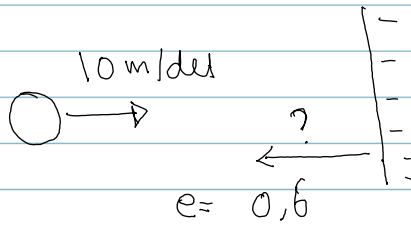
Koefisien restitusi menyatakan seberapa besar kee relatif benda Setelah tumbukan dibandingkan dengan kee relatif benda ~~sebelum~~ tumbukan



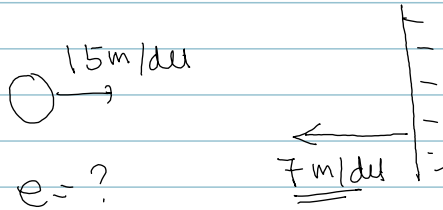
$$0 \leq e \leq 1$$

Latihan

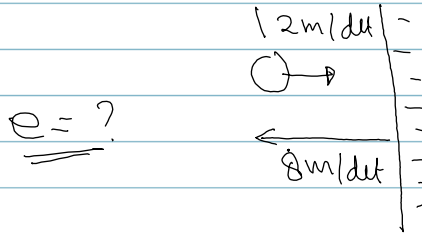
1)



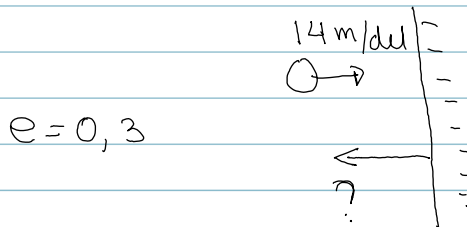
2)

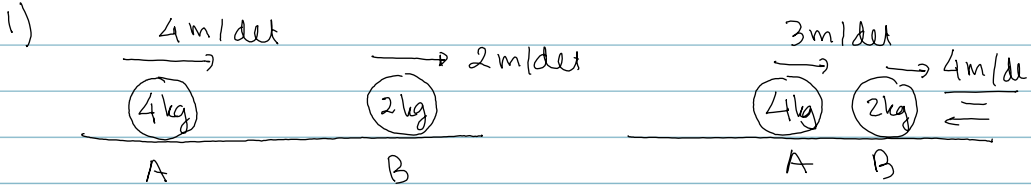


3)



4)





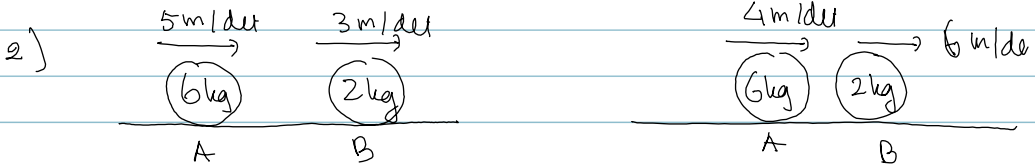
Sebelum

$$V_{A/B} = 2 \text{ m/det (kekanan)}$$

$$e = \frac{1}{2} = \underline{\underline{0,5}}$$

Sesudah

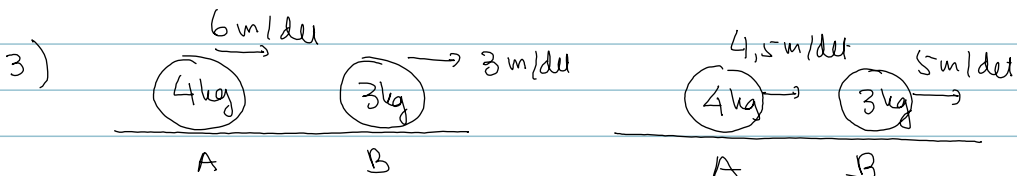
$$V'_{A/B} = 1 \text{ m/det (kekiri)}$$



$$V_{A/B} = 2 \text{ m/det (kekanan)}$$

$$V'_{A/B} = 2 \text{ m/det (kekiri)}$$

$$e = \frac{2}{2} = 1 \Rightarrow \text{lenting sempurna.}$$

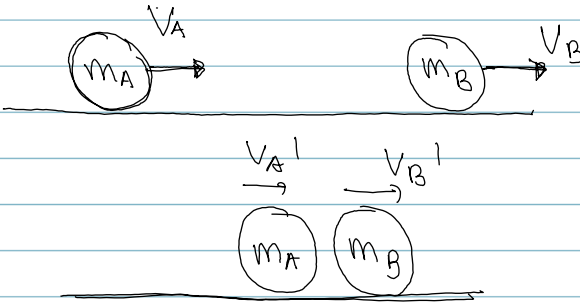


$$V_{A/B} = 3 \text{ m/det (kekanan)}$$

$$V'_{A/B} = 0,5 \text{ m/det (kekiri)}$$

$$e = \frac{0,5}{3} = \frac{1}{6} //$$

4)

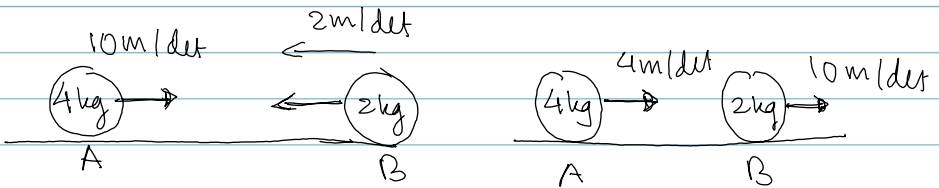


$$v_{A/B} = v_A - v_B \text{ (kekanan)}$$

$$v'_{A/B} = v_A' - v_B' \text{ (kekanan)} = -(v_A' - v_B') \text{ ke kiri}$$

$$e = \frac{-(v_A' - v_B')}{v_A - v_B}$$

5)

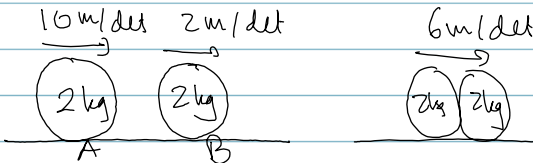


$$v_{A/B} = 12 \text{ m/det (kanan)}$$

$$v'_{A/B} = 6 \text{ m/det (ke kiri)}$$

$$e = \frac{6}{12} = 0,5 //$$

6)

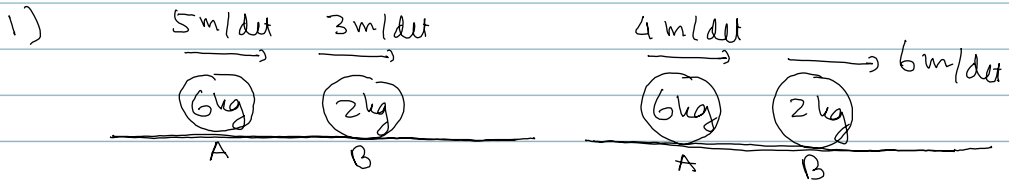


$$v_{A/B} = 8 \text{ m/det (kekanan)}$$

$$v'_{A/B} = 0$$

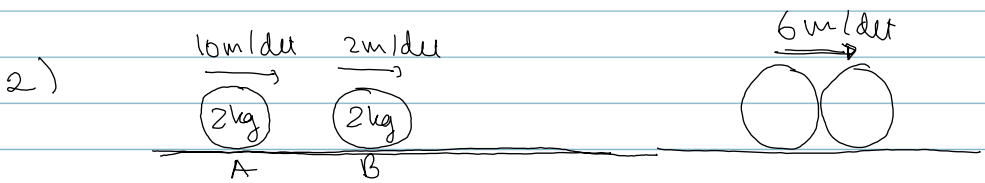
$$e = 0$$

Jenis tumbukan



Elastik Sempurna

- ⊙ $e = 1$
- ⊙ Energi Sebelum tumbukan = 84 J
Sesudah = 84 J



Tidak elastik sama Sekali

$e = 0$

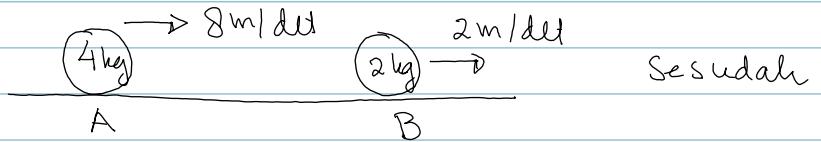
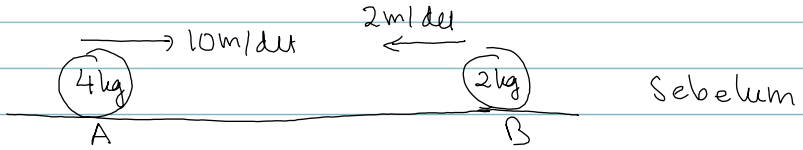
3) elastik sebagian

$0 < e < 1$

⊙ Kerjakan latihan hal 14-17, hitung e dan tentukan Jenis tumbukan

Soal menantang

a) Apakah tumbukan ini mungkin terjadi ?

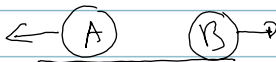
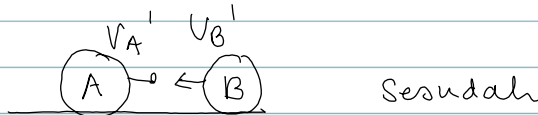
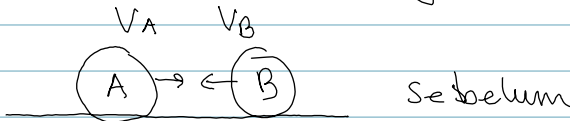


$$E_{\text{sebelum}} > E_{\text{sesudah}}$$

$$P_{\text{sebelum}} = P_{\text{sesudah}}$$

$$e = -$$

b) Apakah proses ini mungkin terjadi ?



$$v_{A/B} = - v'_{A/B}$$