LTN - Usaha & energi

① Dik = $\vec{F}$ = (210 N)$\hat{i}$ - (150 N)$\hat{\delta}$

$\vec{d}$ (perpindahan) = (15 m)$\hat{i}$ - (12 m)$\hat{\delta}$

Dit = W?

↳ $W = \vec{F} \cdot \vec{d}$

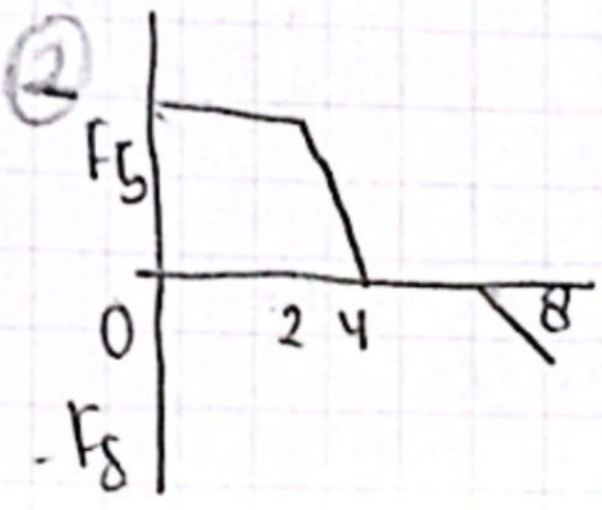
$= F_x \cdot dx + F_y \cdot dy$

F_x = 210 N, F_y = -150 N, dx = 15 m,

dy = -12 m

$= W = (210)(15) + (-150)(-12)$

$= 4950$ J //

② 

Dik : m = 5 kg

F_f = 10 N

x = 0 - 8 m

= Dx = 0 - x = 2

F_8 = 10 N

= sampai

(2) x = 2 - x = 4

gaya = 0 N

(3) x = 4 - x = 8

gaya = $-F_8$ = -10 N

$W = F \cdot d$ d = perpindahan

0 → $W_1 = F_8 \cdot 2 = 10 \times 2 = 20$

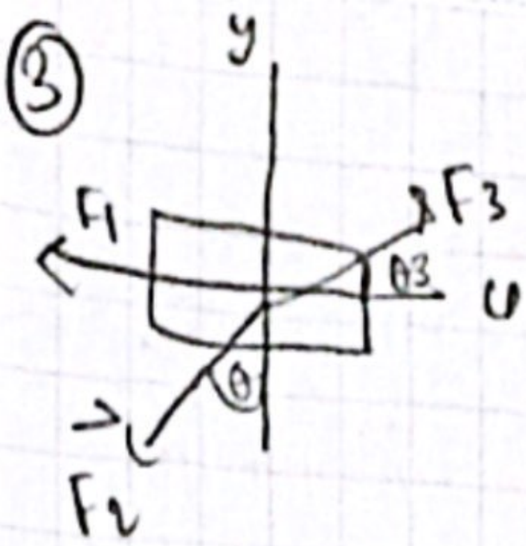
2 → $W_2 = 0 \cdot 2 = 0$

4 → $W_3 = (-F_8) \cdot 4 = -10 \times 4$

$= -40$

$W_{tot} = W_1 + W_2 + W_3$

$= 20 + 0 - 40 = -20$ J //

③ 

Dit = W? $F_1 F_2 F_3$

d = 4 m pertama

Dik = F_1 = 3 N → kanan

F_2 = 4N θ_2 = 50° (horizontal

F_3 = 10N θ_3 = 35°

d = 4m (x)

↳ $W = F \cdot d \cdot \cos\theta$

(1) $W_1 = F_1 \cdot d \cdot \cos 0°$ (F_1)

$= 3 \cdot 4 \cdot 1 = 12$ J

(2) $W_2 = F_2 \cdot d \cdot \cos 50°$ ($\theta_2 = 50°$)

$= 4 \cdot 4 \cdot \cos 50°$

$\cos 50 = 0,6428°$

$W_2 = 4 \cdot 4 \cdot 0,6428$

$= 10,28$ J

(3) $W_3 = F_3 \cdot d \cdot \cos 35°$ ($\theta_3 = 35°$)

$10 \cdot 4 \cdot 0,8192$

$= 32,77$ J

→ $W_{tot} = W_1 + W_2 + W_3$

$= 12 + 10,28 + 32,77$

$= 55,05$ J //

(4) Dik: $m = 2\,kg$

$F(u) = -6u\ N$

$V = u = 3\,m$

$v = 0\ m/s$

Dit: (a) $V_{obyek} = u = 4m$

(b) Posisi u pada kecepatan obyek $v = 5\ m/s$

$\Rightarrow W = \int_{x1}^{x2} F(u)\,du$

$= \int_{3}^{4} -6u\,du$

$= -6 \int_{3}^{4} u\,du$

$\int u\,du = \frac{u^2}{u} =$

$(=) W = -6\left[\frac{u^2}{2}\right]_3^4$

$= -6\left(\frac{4^2}{2} - \frac{3^2}{2}\right)$

$= -6\left(\frac{16}{2} - \frac{9}{2}\right)$

$= -6 . \frac{7}{2} = -21\,J$

Perubahan energi kinetik:

$W = \Delta Ek = \frac{1}{2} m v_2^2 - \frac{1}{2} m v_1^2$

$m = 2\,kg ; v_1 = 8\ m/s ; W = -21\,J$

$-21 = \frac{1}{2} . 2 . v_2^2 - \frac{1}{2} . 2 . 8^2$

$-21 = v_2^2 - 64$

$v_2^2 = 43$

$v_2 = \sqrt{43} \approx 6,56\ m/s$

(b) $W = \frac{1}{2} m v^2 - \frac{1}{2} m v_1^2$

$= \frac{1}{2} . 2 . 5^2 - \frac{1}{2} . 2 . 8^2$

$= (25 - 64) = -39\,J$

$W = \int_3^u -6u\,du =$

$-39 = -6 \int_3^u u\,du$

$-39 = -6 \left[\frac{u^2}{2}\right]_3^u$

$-39 = -6 \left(\frac{u^2}{2} - \frac{3^2}{2}\right)$

$-39 = -6 . \frac{u^2 - 9}{2}$

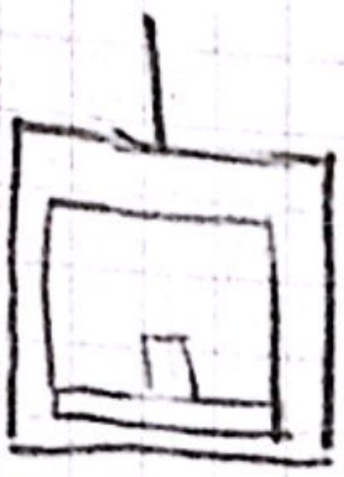
$-39 = -3 (u^2 - 9)$

$13 = u^2 - 9$

$u^2 = 9 + 13$

$u^2 = 22$

$u = \sqrt{22} \approx 4,69\ m$

⑤ 

Diket: M balon : 0,25 kg
m_{lift} : 900 kg
d_1 = 2,40 m
d_2 : 10,5 m
f_N : 3 N

Dit: a) Usaha yang dilakukan o/ gaya dari kabel lift sejauh d_1 jika f_N = 3 N!
b) gaya f_N jika W akibat F konstan d_2 = 92,61 kg

a) f_N = 3 N

$f_N = m.g - m.a$

$3 = (0,25 \times 9,8) - (0,25 \times a)$

$3 = 2,45 - 0,25a$

$0,25a = 2,45 - 3$

$0,25a = -0,55$

$a = \frac{-0,55}{0,25} = -2,2 \, m/s^2$

② $f_{tot} = (N + m).a$

$= (900 + 0,25).(-2,2)$

$= 900,25 . (-2,2)$

$= -1980,55 \, N$

↓ kebawah

W = 1980,55 . 2,40

= 4753,32 J

b) W = 92,61 kJ → 92610 J

→ $F_{tot} = \frac{W}{d_2}$

$= \frac{92610}{10,5} = 8820 \, N$

→ $F_{tot} = (N + m).a$

$8820 = (900 + 0,25).a$

$a = \frac{8820}{900,25} = 9,78 \, m/s^2$

→ **$F_N = m.g - m.a$**

$F_N = (0,25.9,8) - (0,25.9,78)$

$= 2,45 - 2,445$

$= 0,005 \, N$

⑥ Diket: bola m = 1 kg

$v_{awal} = (18 \frac{m}{s}) \hat{i} + (24 \frac{m}{s}) \hat{j}$

Dit: Δ energi t = 6 s

t = 0 - 6 s!

(a) $y = y_0 + v_{0y} \cdot t - \frac{1}{2} g t^2$

$\boxed{y = 0}$

$y = 0 + (24.6) - \frac{1}{2} \cdot 9{,}8 (6)^2$

$= 32{,}4$ m

↓ turun

$\Delta U = m \cdot g \cdot \Delta h$

$\boxed{\Delta h = -32{,}4}$

$= 1 \cdot 9{,}8 \cdot (-32{,}4)$

$= -317{,}52$ J

(7)

$\Delta U = m \cdot g \cdot h$

$\theta = 30^\circ$

$F = 270$ N

$= 2$ cm

$= 0{,}02$ m

Balok bahan 1 : 5,5 cm

$= 0{,}055$ m

(a) $F = k \cdot U$

$k = \frac{F}{U} = \frac{270}{0{,}02} = 13500$ N/m

2) konservasi energi

Posisi awal :

$E_{pot\ awal} = m \cdot g \cdot h$

$= m \cdot g \cdot (d \sin \theta)$

$E_{pot\ pegas} = \frac{1}{2} k U^2$

$\boxed{U = 0{,}055 m}$

konservasi energi

$m \cdot g \cdot (d \sin \theta) = \frac{1}{2} k U^2$

$12 \cdot 9{,}8 \cdot 0{,}5 \cdot d = \frac{1}{2} \cdot 13500 \cdot 0{,}003025$

$58{,}8 d = 20{,}41875$

$d = \frac{20{,}41875}{58{,}8}$

$d = 0{,}347$ m

(b) $U = 0{,}347 - 0{,}055$

$= 0{,}292$ m

$m \cdot g \cdot (d_1 \sin \theta) = \frac{1}{2} m v^2$

$12 \cdot 9{,}8 \cdot (0{,}292 \cdot 0{,}5) = \frac{1}{2} \cdot 12 \cdot v^2$

$17{,}1504 = 6 \cdot v^2$

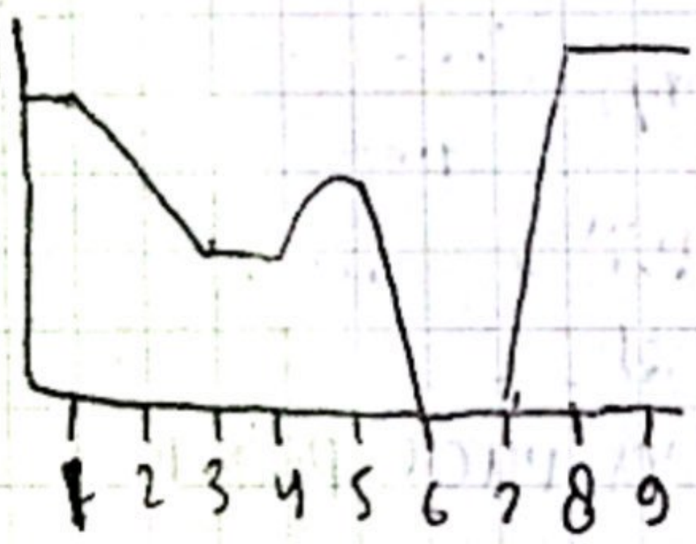
$v^2 = \frac{17{,}1504}{6}$

$v^2 = 2{,}8584$

$v = \sqrt{2{,}8584}$

$= 1{,}69$ m/s

8)



$\Delta U = m = 0{,}2$ kg

$U_B = 12$ J

$U = 4$ J

$U_A = 9$ J $\quad U_C = 20$ J

$U_B = 12$ J $\quad U_D = 24$ J

⇒ E mekanik : EB + EK
= 12J + 4J = 16J

a) x = 3,5 m
Ek(x) = EA = 9J
E = 16J
Ep = E - Ek = 16J - 9J
= 7J

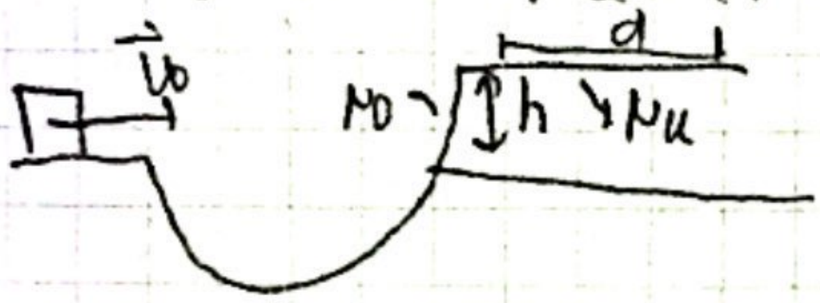
$E_k = \frac{1}{2}mv^2$

$v = \sqrt{\frac{2K}{m}} = \sqrt{\frac{2 \times 7}{0,2}} = \sqrt{70} = 8,37$ m/s

b) x = 6,5 m
Ek(x) = EC = 20J
E = 16J
Ek > E !

c) Posisi titik balik Partikel kanan
Ek = E ⇔ Ek = 16J ⇔ x = 5,5 m
dari grafik

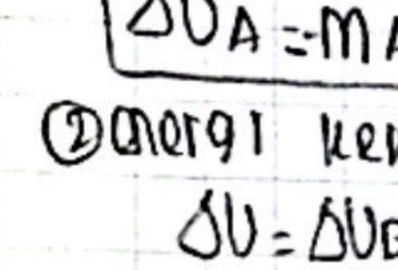
d) ——— , kiri
Ek = 16J ⇔ x = 1 m



Dik : v0 = 6 m/s
h = 1,1 m
μk = 0,60
Dit : jarak d pada permukaan kasar
Jawab : Emekanik awal = licin ;
Eawal = E.kin + E.pot
$= \frac{1}{2}mv_0^2 + mgh$
licin ⇒ g perlu ihung
- Emekanik akhir = kasar ;
Wgesek = Fgesek . d
= μk . m . g . d

- Energi kelereng : Eawal = mgh + Wgesek
$\frac{1}{2}.mv_0^2 + mgh = \mu_k mg.d$
- Menghitung jarak (m) ;
$\frac{1}{2}v_0^2 + gh = \mu_k . g . d$
$d = \frac{\frac{1}{2}v_0^2 + g.h}{\mu_k . g}$
$= \frac{\frac{1}{2}.6^2 + 9,8.1,1}{0,60.9,8}$
= 4,89456 m

10)



Dik : m_A = 1 kg
m_B = 2 kg
θ = 30°
B jatuh = 25 cm
= 0,025 m
Dit : tot. Ek kedua balok setelah B = 25 cm (jatuh) ?
Jawab : ① energi potensial gravitasi awal & akhir :
$\Delta U_B = m_B . g . h$
A = h sin θ → vertikal
$\Delta U_A = m_A . g . h . \sin\theta$
② Energi kekekalan mekanik :
$\Delta U = \Delta U_B + \Delta U_A$
$\Delta U = m_B . g . h - m_A . g (h \sin\theta)$
③ Tot Ek Balok :
$E_{kot} = \Delta U$
④ Sudut miring : m_A = 1 kg dulu
$\Delta U = m_B . g . h - m_A g (h \sin\theta)$
$= (2 . 9,8 . 0,25) - (1 . 9,8 . 0,25 . 0,5)$
= 3,675 J