Wednesday 10/12/2025

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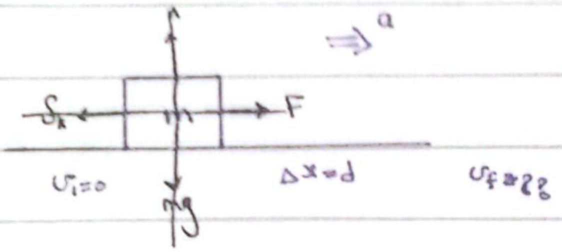
Ex: 8.4] Solve by Newton's law



$\sum F_y = 0 \Rightarrow \boxed{n = mg}$

$\sum F_x = ma$

$F - f_k = ma$

$\boxed{F - \mu_k n = ma}$

$a = \dfrac{F - \mu_k n}{m} \Rightarrow \boxed{a = \dfrac{F - \mu_k mg}{m}}$

$\rightarrow v_f^2 = \cancelto{0}{v_i^2} + 2a\Delta x$

$v_f^2 = 2\left(\dfrac{F - \mu_k mg}{m}\right) d$

$v_f = \sqrt{\dfrac{2(Fd - \mu_k mgd)}{m}}$ ← نفس القبل

* بس الطريقة (٤) أسهل.

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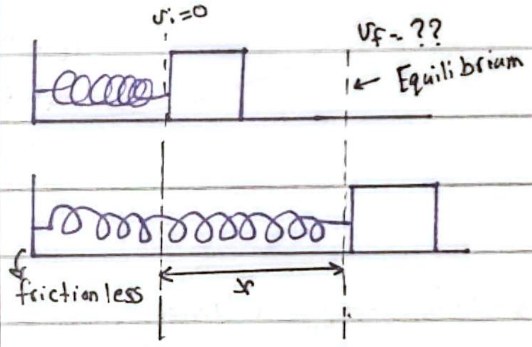
Ex 8.6: A block of mass 1.6 kg is attached to a horizontal spring that has a force constant of 1000 N/m as shown in Figure ②. The spring is compressed 2 cm and is the released from rest ($v_i = 0$) as in Figure ①.

(A) Calculate the speed of block as it passes through the equilibrium position $x = 0$ if the surface is frictionless.



$m = 1.6\,kg$

$k = 10^3\,N/m$

$x = 2 \times 10^{-2}\,m$

$K_i = 0$ $\quad$ $K_f = \frac{1}{2} m v_f^2$

$U_s = \frac{1}{2} k x^2$ $\quad$ $U_{s_f} = 0$

لأن الضم صغيرة

$\Delta K + \cancelto{0}{\Delta U_g} + \Delta U_s = -\cancelto{0}{f_k d} + \cancelto{0}{W_{app}}$

$(K_f - \cancelto{0}{K_i}) + (\cancelto{0}{U_{s_f}} - U_{s_i}) = 0$

$\frac{1}{2} m v_f^2 - \frac{1}{2} k x^2 = 0$

$\cancel{\frac{1}{2}} m v_f^2 = \cancel{\frac{1}{2}} k x^2 \Rightarrow v_f^2 = \dfrac{k x^2}{m}$

$\boxed{v_f = \sqrt{\dfrac{k x^2}{m}}}$ $\quad$ $\boxed{v_f = 0.5\ m/s}$

$f_k = \mu_k n$

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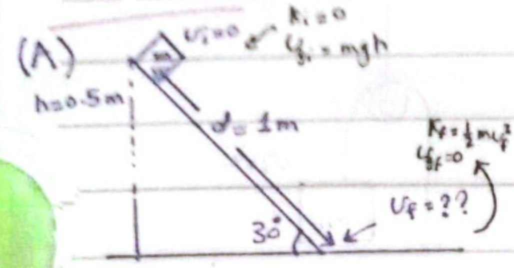
Ex 8.7:

(A)



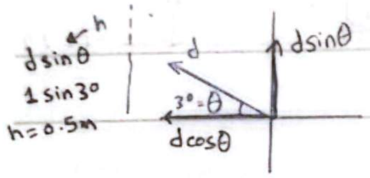
$m = 3kg$

$v_i = 0$

$f_k = 5N$

$d = 1m$ / $\theta = 30°$

$v_f = ??$



*كيف اوجدنا [h] :

$$\Delta K + \Delta U_g + \cancel{\Delta U_s} = -f_k d + \cancel{W_{app}}$$

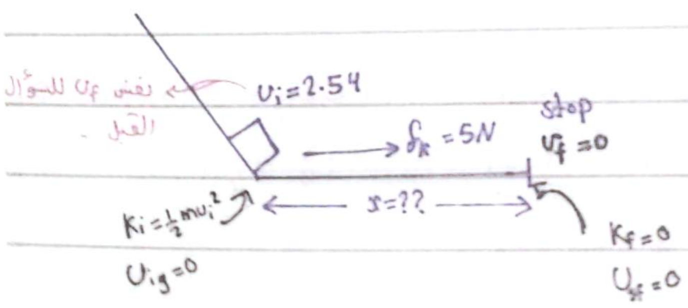
$$(K_f - \cancel{K_i}) + (\cancel{U_{gf}} - U_{gi}) = -f_k d$$

$$\frac{1}{2}mv_f^2 - mgh = -f_k d$$

$$\frac{1}{2}mv_f^2 = mgh - f_k d$$

$$\boxed{v_f = \sqrt{\frac{2(mgh - f_k d)}{m}}} \qquad \boxed{v_f = 2.54\ m/s}$$

(B) if the object moves horizontally until stop.



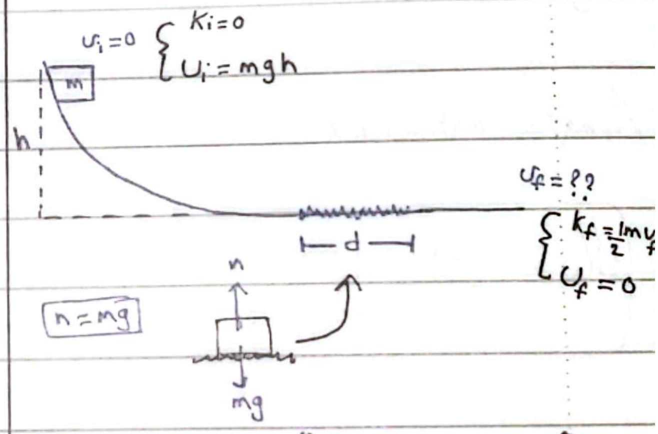
$$\Delta K + \Delta U_g + \cancel{\Delta U_s} = -f_k d + \cancel{W_{app}}$$

$$(\cancel{K_f} - K_i) + (\cancel{U_f} - \cancel{U_i})_g = -f_k d$$

$$-\frac{1}{2}mv_i^2 = -f_k d$$

$$\boxed{d = \frac{mv_i^2}{2f_k}} \qquad \boxed{d = 1.93\ m}$$

Ex:



$$\Delta K + \Delta U_g + \cancel{\Delta U_s} = -f_k d + \cancel{W_{app}}$$

$$(K_f - \cancel{K_i}) + (\cancel{U_f} - U_i)_g = -\mu_k n d$$

$$\frac{1}{2}mv_f^2 - mgh = -\mu_k mgd$$

$$\frac{1}{2}\cancel{m}v_f^2 = \cancel{m}gh - \mu_k \cancel{m}gd$$

$$\boxed{v_f = \sqrt{2(gh - \mu_k gd)}}$$

chapter 8 problems

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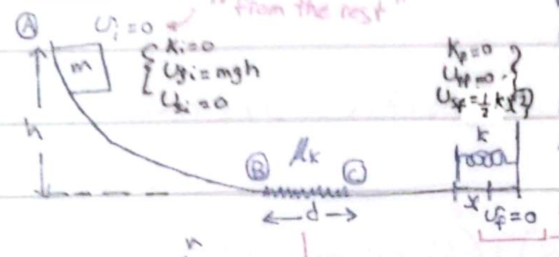
Q_{63}



$\begin{cases} K_i = 0 \\ U_{gi} = mgh \\ U_{si} = 0 \end{cases}$

$\begin{cases} K_f = 0 \\ U_{gf} = 0 \\ U_{sf} = \frac{1}{2}kx^2 \end{cases}$

$h = 3m$

$m = 10kg$

$d = 6m$

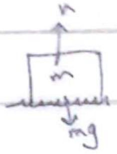
$k = 2250 N/m$

$x = 0.3m$

$\mu_k = ??$

$\sum F_y = 0$

$\boxed{n = mg}$



$$\Delta K + \Delta U_g + \Delta U_s = -f_k d + \cancel{W_{app}}$$

$$(\cancel{K_f} - \cancel{K_i}) + (\cancel{U_f} - U_i)_g + (U_f - \cancel{U_i})_s = -\mu_k n d$$

$$-mgh + \frac{1}{2}kx^2 = -\mu_k mg d$$

$$\mu_k mg d = mgh - \frac{1}{2}kx^2$$

$$\boxed{\mu_k = \frac{mgh - \frac{1}{2}kx^2}{mgd}}$$

$$\boxed{\mu_k = 0.48}$$

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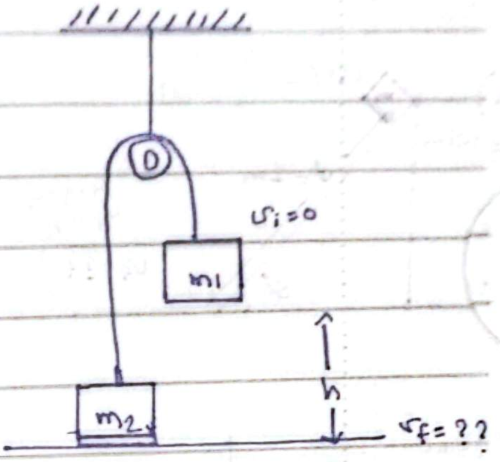
Q_7

* ال 44 سؤال في الصحيفة نفس [illegible] #



$m_1 = 5kg$

$m_2 = 3kg$

$h = 4m$

$v_f = ??$

(at m_1 reach ground)

الطريقة الأولى

[1] (Newton's)

$$\boxed{a = \frac{m_1 g - m_2 g}{m_1 + m_2}}$$

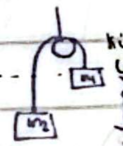
$$v_f^2 = \cancel{v_i^2} + 2a\Delta y$$

$$v_f^2 = (2)\frac{(m_1 - m_2)g}{m_1 + m_2}h$$

$$\boxed{v_f = \sqrt{\frac{(2)gh(m_1 - m_2)}{(m_1 + m_2)}}}$$

الطريقة الثانية

[2] (Energy)



$K_{f_2} = \frac{1}{2}m_2 v_f^2$

$U_{f_2} = m_2 g h$

$K_{i_1} = 0$

$U_{i_1} = m_1 g h$

$K_{f_1} = \frac{1}{2}m_1 v_f^2$

$U_{f_1} = 0$

$K_{i_2} = 0$

$U_{i_2} = 0$

$$\Delta K_1 + \Delta K_2 + \Delta U_{1g} + \Delta U_{2g} + \cancel{\Delta U_{s_1}} + \cancel{\Delta U_{s_2}} = -\cancel{f_k d_1} - \cancel{f_k d_2} + \cancel{W_{app}} + \cancel{W_{app_2}}$$

$$(K_{1f} - \cancel{K_{1i}}) + (K_{2f} - \cancel{K_{2i}}) + (\cancel{U_f} - U_i) + (U_{2f} - \cancel{U_{2i}}) = 0$$

$$\frac{1}{2}m_1 v_f^2 + \frac{1}{2}m_2 v_f^2 - m_1 gh + m_2 gh = 0$$

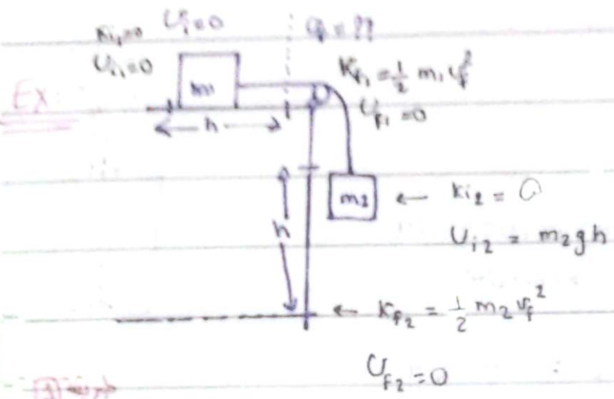
$$\frac{1}{2}v_f^2(m_1 + m_2) - gh(m_1 - m_2) = 0$$

$$\frac{1}{2}v_f^2(m_1 + m_2) = gh(m_1 - m_2)$$

$$\boxed{v_f = \sqrt{\frac{2gh(m_1 - m_2)}{(m_1 + m_2)}}}$$

Monday 15/12/2025

Ex



الطريقة 1

1 (Newton's)

$$\boxed{a=\frac{m_2g}{m_1+m_2}}$$

$$v_f^2=\cancel{v_i^2}^{0}+2a\Delta x$$

$$v_f^2=2\left(\frac{m_2g}{m_1+m_2}\right)h$$

$$\boxed{v_f=\sqrt{\frac{2h(m_2g)}{m_1+m_2}}}$$

الطريقة الثانية

2 (Energy)

$$\Delta K_1+\Delta K_2+\Delta U_1+\Delta U_2=0$$

$$(K_{f_1}-\cancel{K_{i_1}}^{0})+(K_{f_2}-\cancel{K_{i_2}}^{0})+(\cancel{U_{f_1}}^{0}-\cancel{U_{i_1}}^{0})+(\cancel{U_{f_2}}^{0}-U_{i_2})=0$$

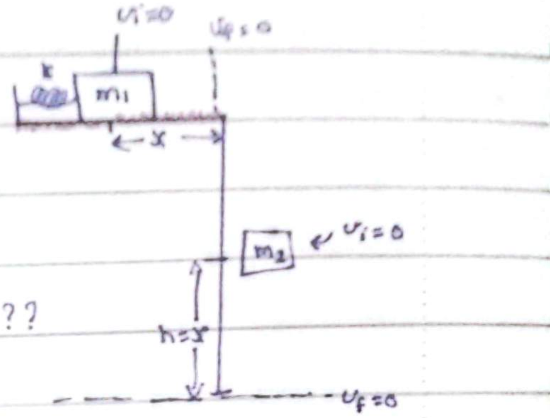
$$\frac{1}{2}m_1v_f^2+\frac{1}{2}m_2v_f^2-m_2gh=0$$

$$\frac{1}{2}v_f^2(m_1+m_2)=m_2gh$$

$$\boxed{v_f=\sqrt{\frac{2m_2gh}{m_1+m_2}}}$$

k يصير في هذا السؤال x = k لأن المسافة إلي قطعها الجسم
وصار ملامس + الزنبرك بضغطها إلي نزلها الجسم ونشا ذي إلي
نفسه h

Ex



$\mu_k=??$

$$\Delta\cancel{K_1}^{0}+\cancel{\Delta K_2}^{0}+\Delta\cancel{U_{g_1}}^{0}+\Delta U_{g_2}+\Delta U_{s_1}+\Delta\cancel{U_{s_2}}^{0}=-f_{k_1}d_1-\cancel{f_{k_2}d_2}^{0}+\cancel{W_{app}}^{0}$$

$$(\cancel{U_{2fg}}^{0}-U_{2ig})+(U_{sf_1}-\cancel{U_{si_1}}^{0})=-\mu_k n\,x$$

$\boxed{n=m_1g}$

$$-m_2g\cancel{x}+\frac{1}{2}kx^{\cancel{2}}=-\mu_k m_1g\cancel{x}$$

$$\boxed{\mu_k=\frac{m_2g-\frac{1}{2}kx}{m_1g}}$$

⊛ Power (P)

$$\boxed{P = \frac{W}{t}}$$

$$P = \frac{dW}{dt}$$

$$P = \frac{W}{t} = \frac{Fd\cos\theta}{t}$$

$$\boxed{P = \vec{F} \cdot \vec{v}}$$

$$\boxed{P = Fv\cos\theta}$$

$$\boxed{P = \frac{W}{t} = Fv\cos\theta}$$

$$[P] = \frac{[W]}{[t]} = \frac{J}{s}$$

$$[P] = J/s \ / \ \text{watt}$$

or $[P] = Nm/s \leftarrow \dfrac{\overset{Nm}{Fd\cos\theta}}{\underset{s}{t}}$

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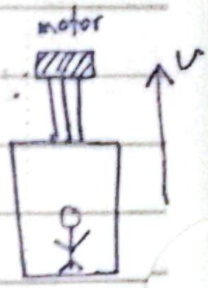
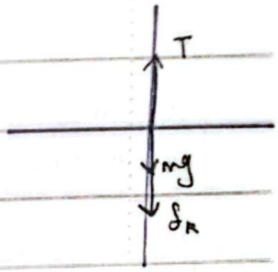
Ex: 8.11



$m_e = 1600$ kg
↳ elevator

$m_p = 200$ kg
↳ passengers

$m_{total} = 1800$ kg



$f_k = 4000\,N$

$v = 3$ m/s } const
$P = ??$

$\Rightarrow a = 0 \Rightarrow \boxed{\Sigma F = 0}$

* القوة المؤثرة (F) هي نفسها قوة الشد .

$T = mg + f_k$

$$P = Fv\cos\theta$$
$$= Tv\cancel{\cos\theta}$$
$$= (mg + f_k)v$$
$$= \left(\left((1800)(9.8)\right) + 4000\right)(3)$$

$$\boxed{P = 6.49 \times 10^4 \ W}$$

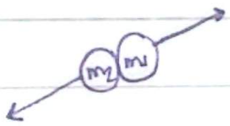
Subject Wednesday 17/12/2025 Date No.

Chapter 9

الزخم
Momentum & Collision ...

before

after



$$\vec{F}_{12} = -\vec{F}_{21}$$

$$\vec{F}_{12} + \vec{F}_{21} = 0$$

$$m_1\vec{a}_1 + m_2\vec{a}_2 = 0$$

$$m_1\frac{d\vec{v}_1}{dt} + m_2\frac{d\vec{v}_2}{dt} = 0$$

$$\int m_1\frac{d\vec{v}_1}{dt} + \int m_2\frac{d\vec{v}_2}{dt} = \int 0\ dt$$

$$m_1\vec{v}_1 + m_2\vec{v}_2 = \text{Const}$$

$$\boxed{\vec{P} = m\vec{v}}$$ linear momentum

$$\vec{P}_1 + \vec{P}_2 = \text{Const}$$

$$\boxed{\underbrace{\vec{P}_{1i} + \vec{P}_{2i}}_{\text{before}} = \underbrace{\vec{P}_{1f} + \vec{P}_{2f}}_{\text{after}}}$$

$$\boxed{\sum \vec{P}_i = \sum \vec{P}_f}$$

$$\sum \vec{P}_i - \sum \vec{P}_f = 0$$

$$\Delta\vec{P} = 0$$

systems

- isolated معزول
  - $\boxed{\Delta\vec{P} = 0}$
  - $\vec{I} = 0$
- non-isolated
  - $\boxed{\Delta\vec{P} = \int_{t_i}^{t_f} \vec{F}\,dt}$
  - $\vec{I} = \Delta\vec{P}$

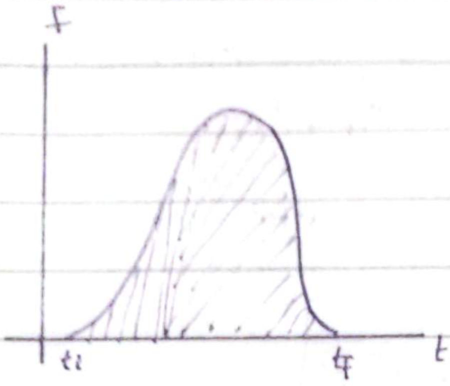
$\vec{I}$ = impuls

$$\Delta\vec{P} = \vec{I}$$

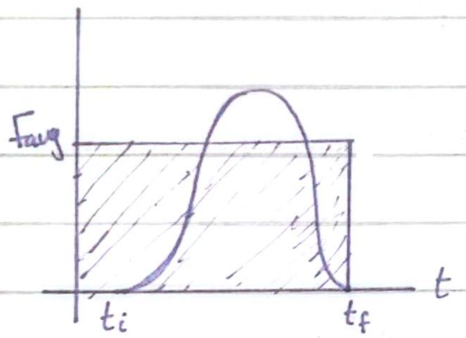
↳ isolated

$$\Delta\vec{P} = 0$$

$$\boxed{I = \int_{t_i}^{t_f} \vec{F}\,dt}$$

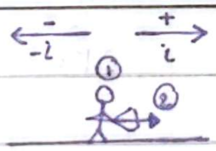


I = Area under crave.



$$\boxed{I = f_{avg}\,\Delta t}$$

Ex: 9.1



$m_1 = 60\ kg$ $\quad v_{2i} = 0$

$v_{1i} = 0$ $\quad v_{2f} = 85\ m/s$

$m_2 = 0.03\ kg$ $\quad v_{1f} = ??$

$$\Sigma P_i = \Sigma P_f$$

$$m_1 \cancel{v_{1i}} + m_2 \cancel{v_{2i}} = m_1 v_{1f} + m_2 v_{2f}$$

$$0 = 60\, v_{1f} + 0.03(85)$$

$$-2.55 = 60\, v_{1f}$$

$$v_{1f} = -0.042\ m/s$$

$$\boxed{v_{1f} = -0.042\ \hat{i}}$$