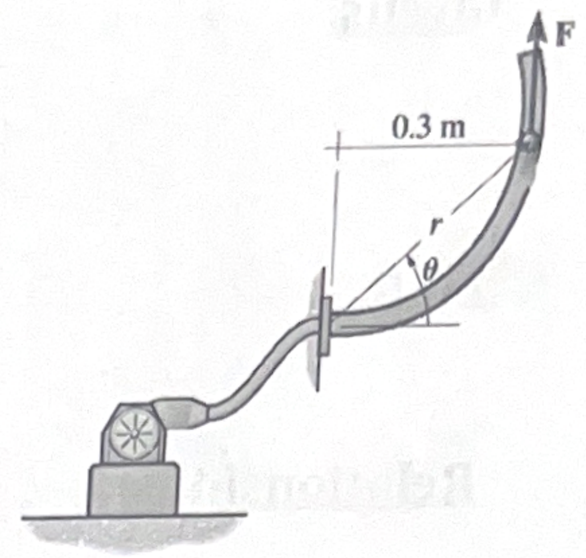
Problem No: **F13-14**	MECHANICAL AND NUCLEAR ENGINEERING DEPARTMENT	Name:
Date:		Section:

Givens: $m = 0.2\,kg$ $r = 0.6\sin\theta$ $t = 0.5\,s$

$g = 9.81\,m/s^2$ $\theta = \pi t^2\,rad$

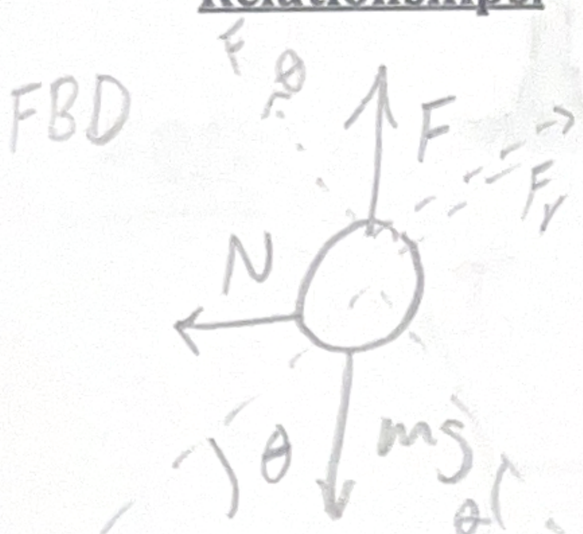


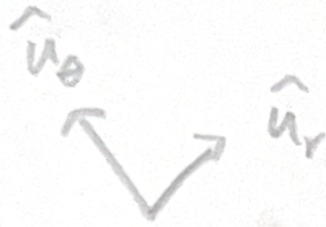
Finds: F

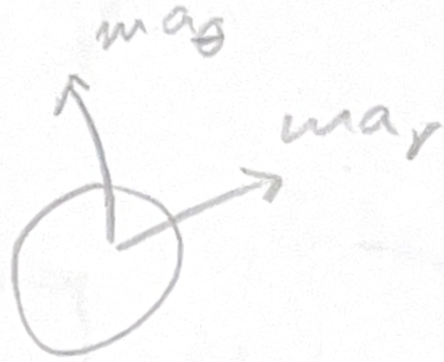
$a_r = \ddot{r} - r\dot{\theta}^2$

$a_\theta = r\ddot{\theta} + 2\dot{r}\dot{\theta}$

Relationships:







$\vec{F} = F_r\hat{u}_r + F_\theta\hat{u}_\theta$

$\sum F_r = -N\cos\theta + F\sin\theta - mg\sin\theta = ma_r$

$\sum F_\theta = N\sin\theta + F\cos\theta - mg\cos\theta = ma_\theta$

$t = 0.5\,s$

θ	πt^2	$\frac{\pi}{4}$
$\dot{\theta}$	$2\pi t$	π
$\ddot{\theta}$	2π	1

r	$0.6\sin\theta = \frac{0.6\sqrt{2}}{2} \rightarrow .424$
$\dot{r}$	$0.6\cos\theta\,\dot{\theta} = \frac{0.6\sqrt{2}}{2}(\pi) \rightarrow 1.33$
$\ddot{r}$	$-0.6\sin\theta = -\frac{0.6\sqrt{2}}{2} \rightarrow -1.52$

$a_r = (-1.52) - \left(\frac{0.6\sqrt{2}}{2}\right)(\pi)^2 \Rightarrow -5.71\,m/s$

$a_\theta = (.424)(1) + 2(1.33)(\pi)$

$\boxed{F = 2.72\,N}$

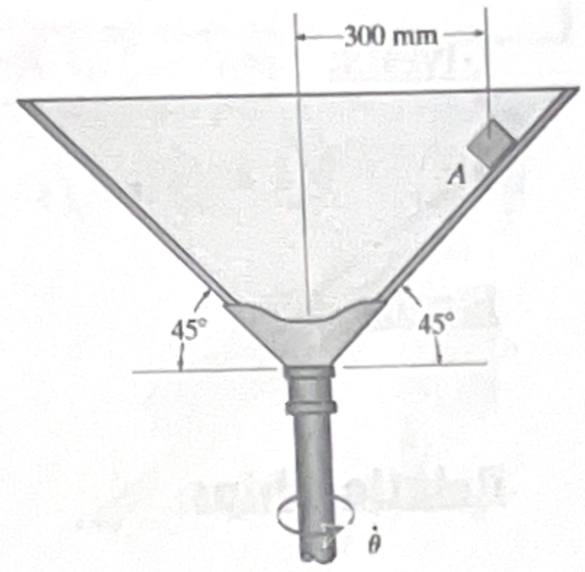
Solve

$N = 2.37\,N$

$F = 2.72\,N$

Problem No: **13-96**	MECHANICAL AND NUCLEAR ENGINEERING DEPARTMENT	Name:
Date:		Section:

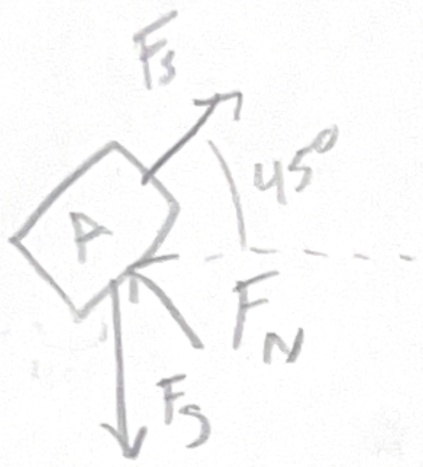
Givens: $\mu_s = 0.2 \quad r = 0.3\,m$

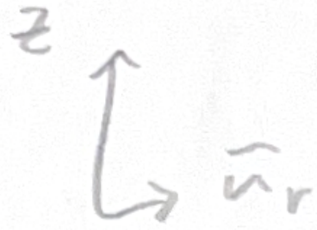


Finds: $\dot{\theta}_{min}$

Relationships:

FBD





kD

$$\sum F_z = -F_s + N\sin 45^\circ + \sin 45^\circ = 0$$

$$\sum F_r = F_s \cos 45^\circ - N\cos 45^\circ = m a_r \Rightarrow g(0.2)\cos 45^\circ - g\cos 45^\circ = a_r$$

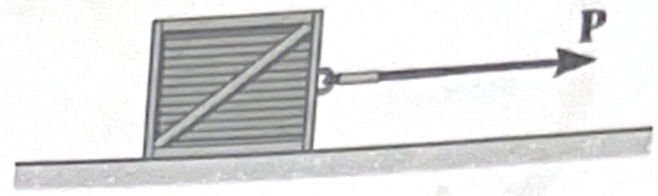
$$a_r = \ddot{r} + (0.3)(\dot{\theta})^2 \qquad a_r = s = -9.81$$

$$\dot{\theta} = 5.7\ rad/s$$

Problem No: **14-9**	MECHANICAL AND NUCLEAR ENGINEERING DEPARTMENT	Name:
Date:		Section:

Givens: $m = 50\ kg \quad v_0 = 0 \quad s = 15\ m$

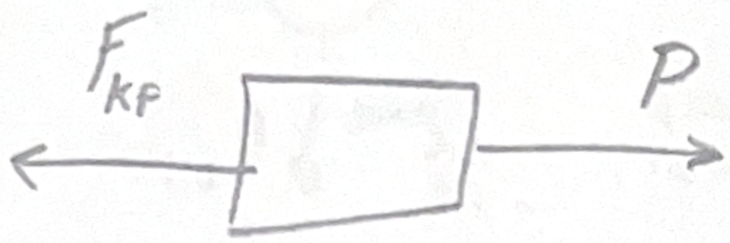
$v_f = 6\ m/s \quad \mu_k = 0.3$



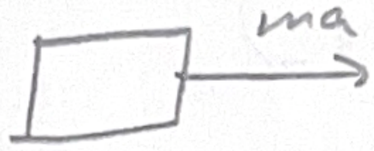
Finds: P

Relationships:

FBD



kD



$$s_f = s_0 + v_0 t + \frac{1}{2} a t^2$$

$$30 = a t^2$$

$$\Sigma F_x = P - F_{kf}$$

$$F_{kf} = \mu F_N = (0.3) mg$$

$$F_{kf} = 147.15\ N$$

$$E_2 = E_1 + (U_{nc})_{12}$$

$$T_2 + \cancel{V_{g2}}^{\,0} + \cancel{V_{e2}}^{\,0} = \cancel{T_1}^{\,0} + \cancel{V_{g1}}^{\,0} + \cancel{V_{e1}}^{\,0} + (U_{nc})_{12}$$

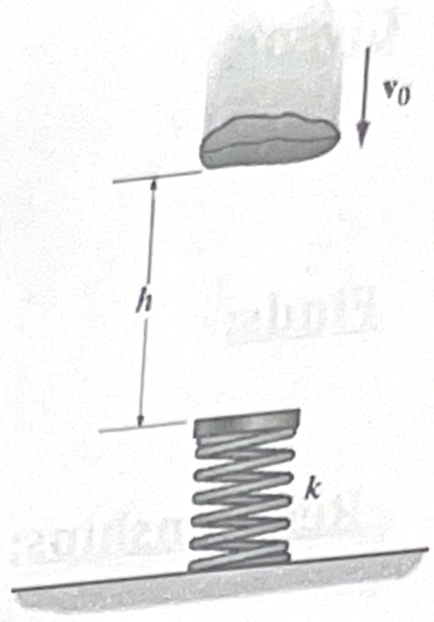
$$T_2 = (U_{nc})_{12}$$

$$T_2 = \frac{1}{2} m v_f^2 = P(15) - 147.15$$

$$\frac{1}{2}\, 50\, (6)^2 = P(15) - 147.15(15)$$

$$\boxed{P = 207.15\ N}$$

Problem No: 14-17	MECHANICAL AND NUCLEAR ENGINEERING DEPARTMENT	Name:
Date:		Section:



Givens: variables

Finds: s_2

Relationships:

$$E_{k_i} + E_{p_i} = E_{s_2}$$

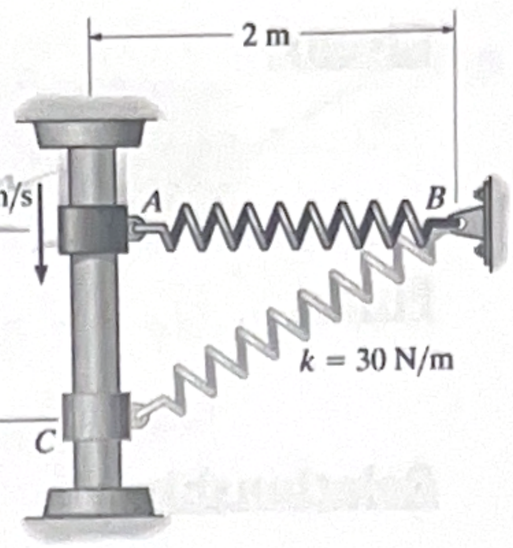
$$\frac{1}{2}mv_1^2 + mgh_1 = \frac{1}{2}ks_2^2$$

$$s_2 = \sqrt{\frac{mv_1^2}{k} + \frac{2mgh}{k}}$$

Problem No: **F14-15**	MECHANICAL AND NUCLEAR ENGINEERING DEPARTMENT	Name:
Date:		Section:

Givens: $m = 2\ kg \quad V_1 = 4\ m/s \quad L_0 = 1\ m$

$g = 9.81\ m/s^2 \quad d = 1\ m \quad k = 30\ N/m$



Finds: V_2

Relationships:

$$T_1 + V_1 = T_2 + V_2$$

$$\frac{1}{2}(m)(v)^2 + \frac{1}{2}ks^2 = \frac{1}{2}mv^2 - 2ad + \frac{1}{2}(k)(s)^2$$

$$\frac{1}{2}(2)(4)^2 + \frac{1}{2}(30)(1)^2 = \frac{1}{2}(2)v^2 - 2(9.81)(1) + \frac{1}{2}(30)(\sqrt{5}-1)^2$$

$$v = 5.26\ m/s$$

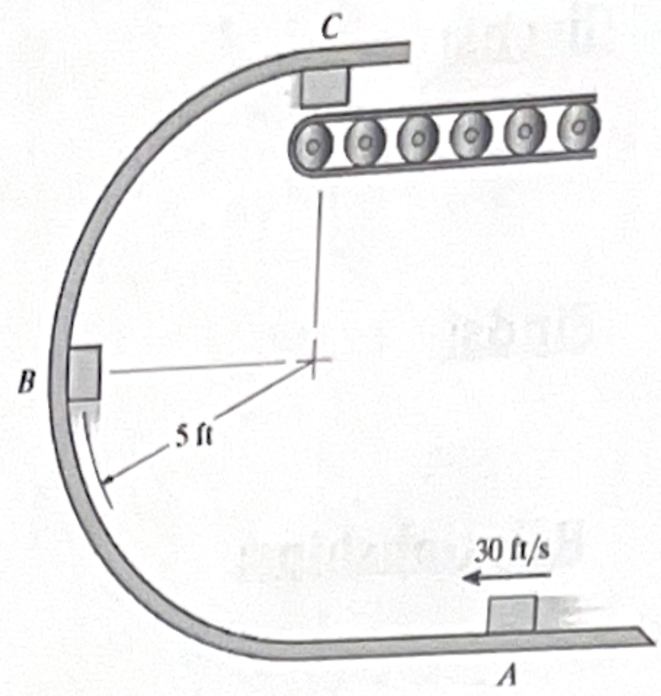
Problem No: **14-34**	MECHANICAL AND NUCLEAR ENGINEERING DEPARTMENT	Name:
Date:		Section:

Givens: $W = 2\,lb$ $\quad V_A = 30\ ft/s$

$g = 32.2\ ft/s^2$ $\quad r = 5\,ft = \rho$

Finds: $V_B \quad N_B$

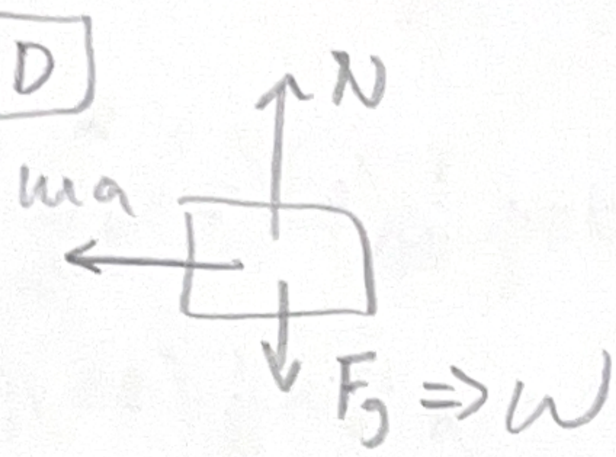
$V_C \quad N_C$



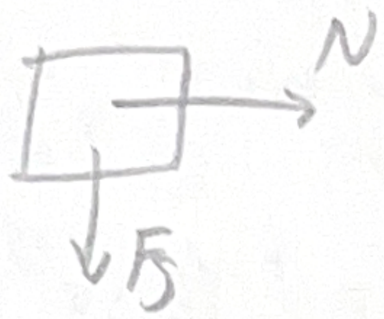
Relationships:

A

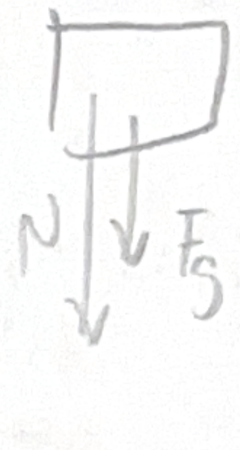
FBD



B

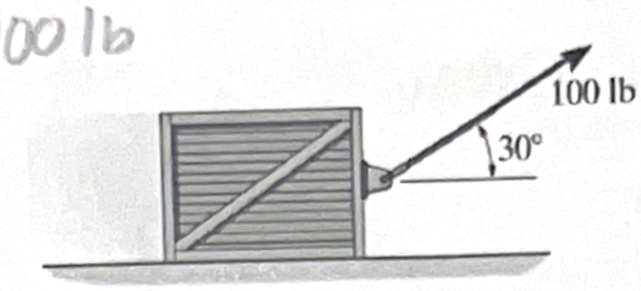


C



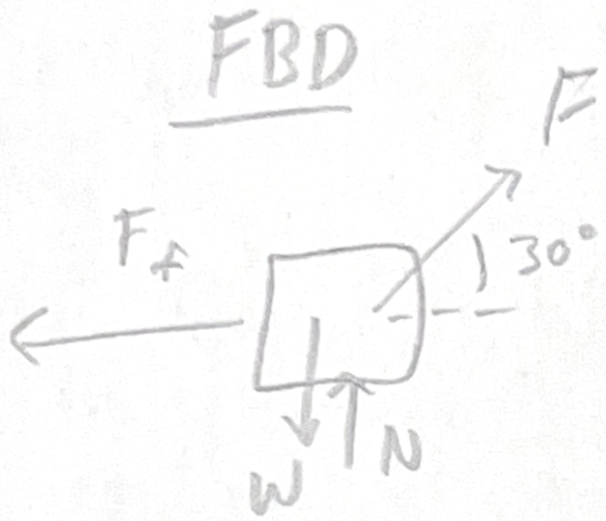
Problem No: **F15-2**	MECHANICAL AND NUCLEAR ENGINEERING DEPARTMENT	Name:
Date:		Section:

Givens: $W = 150\ lb$ $\mu_k = 0.2$ $v_1 = 0$ $t_1 = 0$ $F = 100\ lb$



Finds: v_2 t_2 @ 4s

Relationships:

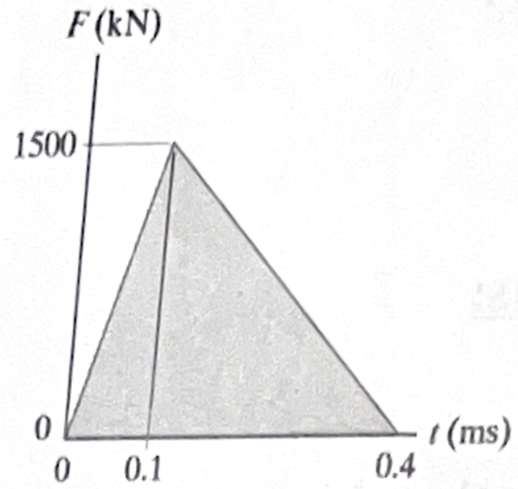


Problem No: **15-11**	MECHANICAL AND NUCLEAR ENGINEERING DEPARTMENT	Name:
Date:		Section:

Givens: $m = 2\,kg$ $v_i = 90\,m/s$

$g = 9.81\,m/s^2$

$t_i = 0$ $t_f = 0.4\,ms$

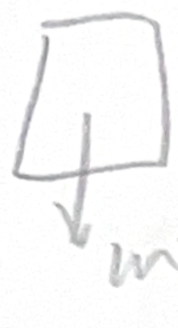


Finds: v_f

Relationships:

FBD

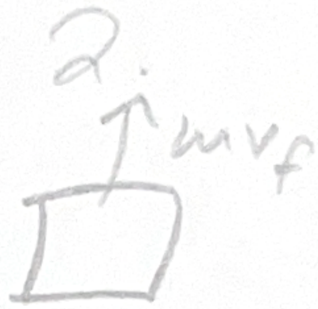
1.



N2L

impulse

2.



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