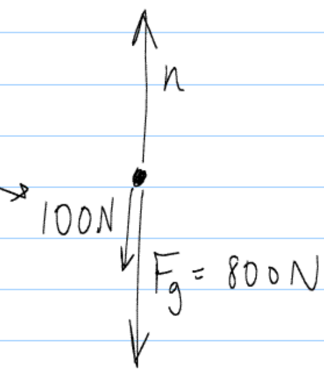
PHY131H1F Centre-screen notes
Wednesday Oct. 17, 2012

fbd of Bob:

arch pushes downward on Bob.





$$(F_{Net})_y = n - 100 - 800 = 0$$

solve for $n = 900\ N$

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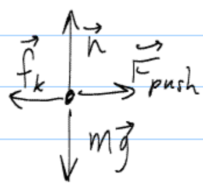
fbd of block;




$\vec{v}$ → then: $\vec{f}_k$ ← (opposes motion)

$a_y = 0$ $(F_{Net})_y = 0$ ⇒ $n = mg = 100N$

$a_x = 0$ ....? Not true!

$f_k = \mu_k n = 0.1(100N) = 10\ N$

$$(F_{Net})_x = F_{push} - f_k = 5 - 10 = -5N.$$

↑ block will slow down.

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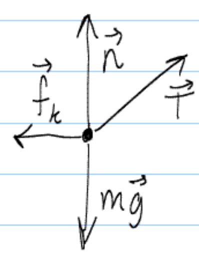
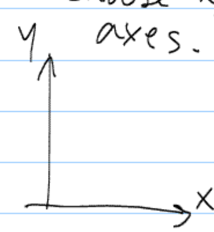
Sled Example.

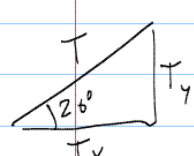
f.b.d. of sled.

constant $\vec{v}$ ⇒ $\vec{a} = 0$




Choose x, y axes.




| | x | y |
|---|---|---|
| $\vec{n}$ | 0 | n |

$\sin 20^\circ = \frac{T_y}{T}$

$\cos 20^\circ = \frac{T_x}{T}$

| | | |
|---|---|---|
| $\vec{T}$ | $T\cos 20$ | $T\sin 20$ |
| $\vec{f}_k$ | $-\mu_k n$ | $0$ |
| $m\vec{g}$ | $0$ | $-mg$ |
| $\vec{F}_{Net}$ | $T\cos 20 - \mu_k n = 0$ | $n + T\sin 20 - mg = 0$ |

$\vec{F}_{Net} = 0$

2 eq's, 2 unknowns: $n$, $T$.
Need $T$.

Solve for $n$ in one eq, plug into other eq.

y-eq: $n = mg - T\sin 20$

plug into x-eq:

$$T\cos 20 - \mu_k(mg - T\sin 20) = 0$$

solve for T:

$$T\cos 20 + T\mu_k \sin 20 - \mu_k mg = 0$$

$$T(\cos 20 + \mu_k \sin 20) = \mu_k mg$$

$$T = \frac{\mu_k mg}{\cos 20^\circ + \mu_k \sin 20^\circ} = \frac{0.030(5)(9.80)}{\cos 20 + (0.03)(\sin 20)}$$

$$\boxed{T = 1.5\ \text{N}}$$

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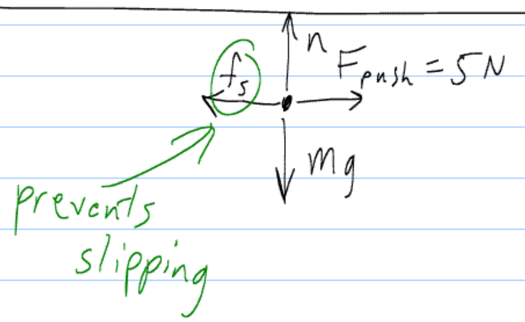


$a_x = 0$

$\Rightarrow (F_{Net})_x = 0$

$0 = F_{push} - f_s$

$\Rightarrow f_s = F_{push}$

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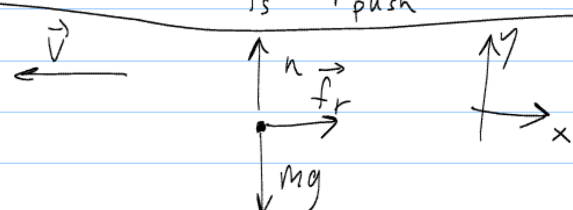
Problem 6.23

f.b.d. of locomotive.




$\vec{f}_r$ opposes motion.

$f_r = \mu_r n$

$(F_{Net})_x = \mu_r n$

$(F_{Net})_y = 0 = n - mg \Rightarrow n = mg$

$n = 50,000(9.8)$

$(F_{Net})_x = 0.002(50,000)(9.8) = 980\text{ N}$

$a_x = \frac{(F_{Net})_x}{m} \Longrightarrow a_x = \frac{980}{50000} = 0.0196\text{ m/s}^2$

$v_i = -10\text{ m/s} \qquad v_f = 0 \qquad t = \text{unknown},$ need $\Delta x$

Use: $v_f^2 \rightarrow 0 = v_i^2 + 2(\Delta x)a_x$

$v_i^2 = -2(\Delta x)a_x$

$\Delta x = -\frac{v_i^2}{2a_x} = \frac{10^2}{-2(0.0196)}$

$\Delta x = -2.55 \times 10^3\text{ m}$

2.55 km, to the left.