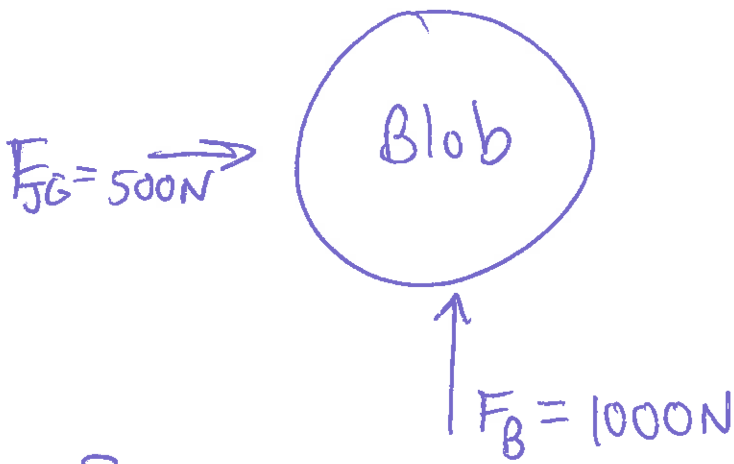
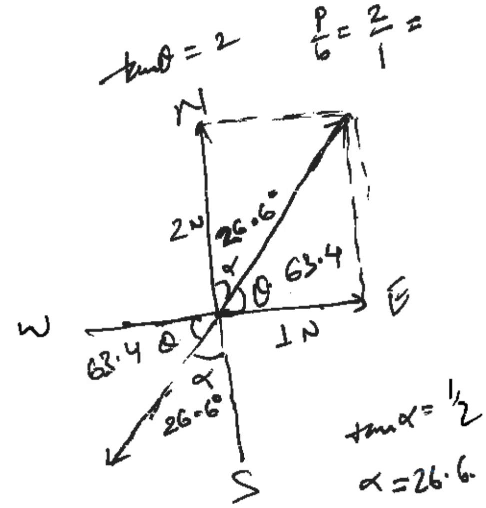
(1) $m_B = 250kg$ $\mu_s = 1.0$ $\mu_K = 0.9$





a) Move?

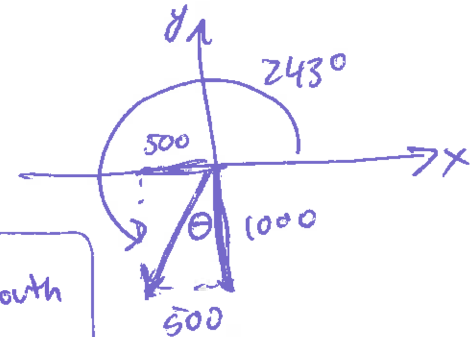
$$\text{Net } |F| = \sqrt{1000^2 + 500^2} = 1118\ N$$

$$F_f \leq n \cdot \mu_s = (250\ kg \cdot 10\ m/s^2)(1.0) = 2500\ N$$

So, No Motion

b) Magnitude of force is $= \boxed{1118\ N}$ — Same as is pushing on him because $a = 0$.

direction is



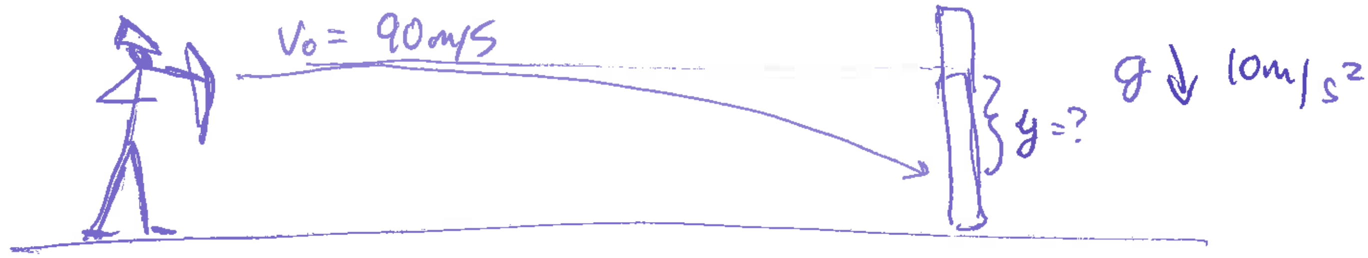
$\tan\theta = \frac{1}{2}$

$\theta = 26.6°$ West of South

or 243°

90 − 26.6

(2)



$x = 200\,m$

X: $x = x_0 + V_0 \cos\alpha\, t \cancel{+ \frac{1}{2} a t^2}$

$200\,m = 0 + 90\,m/s\; t \Rightarrow t = \frac{200}{90}\,s = \underline{2.22\,sec.}$

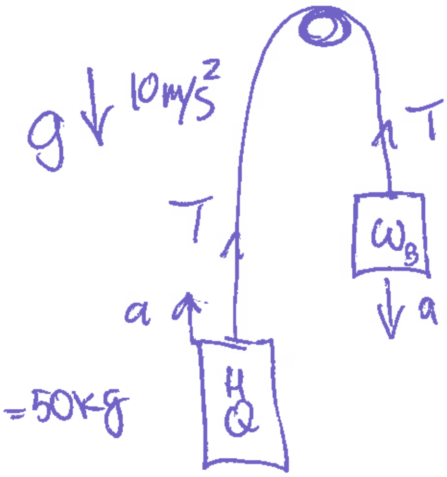
y: $y = y_0 + V_0 \sin\alpha\, t + \frac{1}{2} a t^2$

$y = 0 + 0 - \underbrace{5}_{4.9} t^2$

$\boxed{y = -24.7\,m}$ yikes!

Probably will hit the ground first, right? Gravity is unforgiving!

③



$m_{HQ} = 50\,kg$

$m_B = 200\ kg \quad w = mg = 2000\,N$

$$-w_B + T = -m_B a$$
$$-w_{HQ} + T = m_{HQ} a$$

2 Eq., 2 unknowns. Eliminate T to get:

$$w_B - w_{HQ} = +\underset{200\,kg}{m_B}\, a + \underset{50\,kg}{m_{HQ}}\, a$$

$$2000\,N - 500\,N = a\,(250\,kg)$$

$$1500\,N = a\,(250\,kg)$$

$$\boxed{a = 6\ m/s^2}$$

(4)

Want $a = 10\,m/s^2$ toward center.

What $v = ?$

what rev/minute?

$$a = \frac{v^2}{r}$$

$a = 10\,m/s^2$, $r = 100\,m$

$$v^2 = 1000\,m^2/s^2$$

$$\boxed{v = 31.6\,m/s}$$

Rev/second first:

circumference $C = 2\pi r = 6.28 \cdot 100m$
$= 628m$

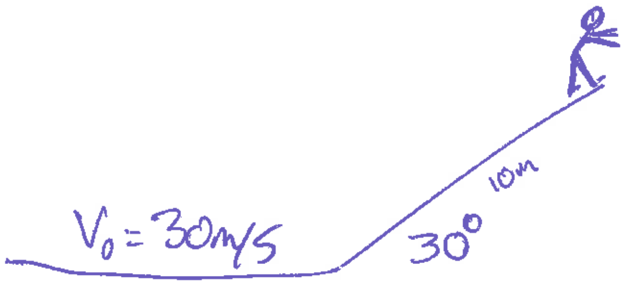
$$V \cdot t = C \Rightarrow t = \frac{628m}{31.6m} = 19.87\ \text{sec. for 1 rev.}$$

$$T\ (\text{period}): 19.87\,\text{sec}/1\,\text{rev.} \Rightarrow \frac{1\ \text{Rev}}{19.87\,\text{sec}}$$

$$= 0.05\ldots\ \text{Rev/sec.}$$

$$0.05\ldots \frac{\text{rev}}{\cancel{\text{sec}}} \cdot \frac{60\,\cancel{\text{sec}}}{1\ \text{minute}} = \boxed{3.02\ \text{rev/minute}}$$

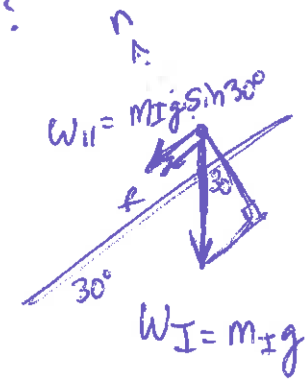
5



$\mu_K = 0.05$

$m_I = 70 kg$

$V_f = ?$



$f = n\mu_K = m_I g \cos\theta \, \mu_K$

$$\sum F_{\parallel} = m_I a \quad \Rightarrow -\cancel{m_I} g \sin 30° - \cancel{m_I} g \cos\theta \, \mu_k = \cancel{m_I} a$$

$$a = -g\left(0.5 + \underbrace{(0.87)(0.05)}_{0.04}\right)$$

$$a = -10\, m/s^2 \,(0.54)$$

$$a \simeq -5.4\, m/s^2$$

Const. a ∥ to ice:

$$x = x_0 + V_{0x} t + \tfrac{1}{2} a_x t^2$$

$$10m = 0 + 30 m/s\, t \quad -5.4 m/s^2\, t^2$$

$$-5.4\, m/s^2 + 30\, m/s\, t - 10m = 0$$

Quad formula:

$$t = 0.36 \text{ sec.}$$

or

$$5.199 \text{ sec.}$$

$$V = V_0 + at$$

30, -5.4, 0.36; $\underbrace{-5.4 \cdot 0.36}_{1.94 m/s}$

$$\boxed{V_f \simeq 28\, m/s}$$

⑥

$a = 100\ m/s^4\ t^2$ a) t for $x = 100$?

$V_0 = 0$ b) $V_f = ?$

$a = \frac{dv}{dt}$ $dv = a\,dt$

$$V = \int_0^t 100\ m/s^4\ t^2\,dt$$

$$V = \frac{100t^3}{3}\Big|_0^t$$

Need t!

$V = \frac{dx}{dt}$ $x = \int_0^t \frac{100t^3}{3}\,dt = 100m$

$$\frac{\cancel{100}}{12}t^4 = \cancel{100}\ m$$

$$t^4 = 12\ m$$

$$\underline{t = 1.86\ sec.}$$

Plug back into formulas.

$V_f = \frac{100t^3}{3}$ @ $t = 1.86$ sec.

$V_f = 214$ m/s