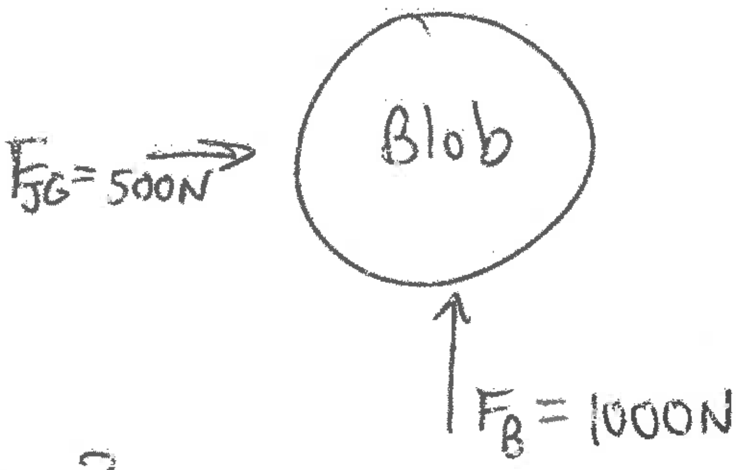
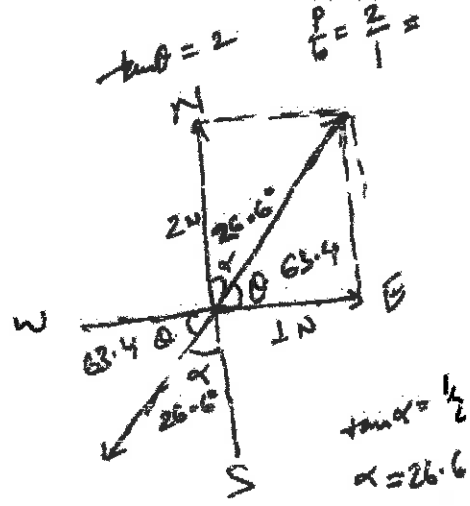
(1)

$m_B = 250\,kg \quad \mu_s = 1.0 \quad \mu_k = 0.9$





a) Move?

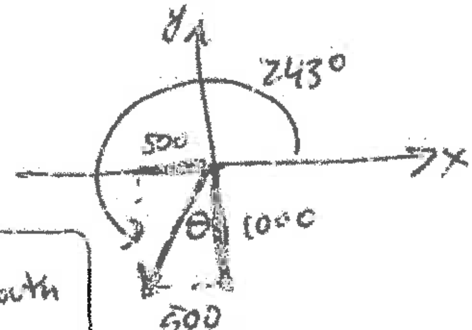
Net $|F| = \sqrt{1000^2 + 500^2} = 1118\ N$

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

So, $\boxed{\text{No Motion}}$

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

direction is

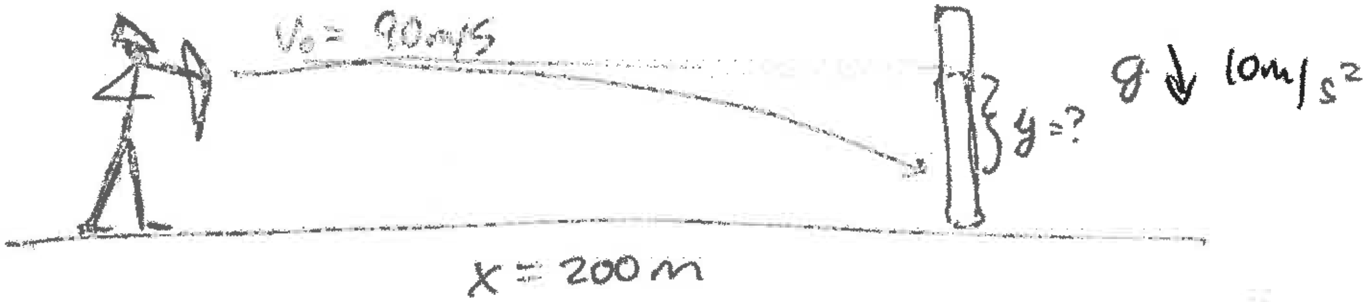


$\tan\theta = \frac{1}{2}$

$\boxed{\theta = 26.6° \text{ West of South} \quad \text{or} \quad 243°}$

90 − 26.6

(3)



X: $x = x_0 + v_0 \overset{1}{\cos\alpha}\, t \cancel{+ \frac{1}{2}at^2} \to 0$

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

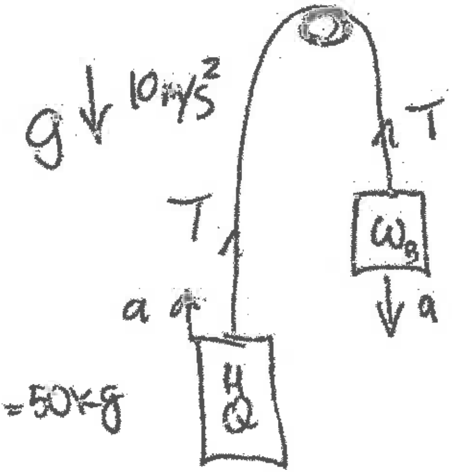
y: $y = y_0 + v_0 \overset{0}{\sin\alpha}\, t + \frac{1}{2}at^2$

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

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

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

3)



$m_{HQ} = 50\,kg$

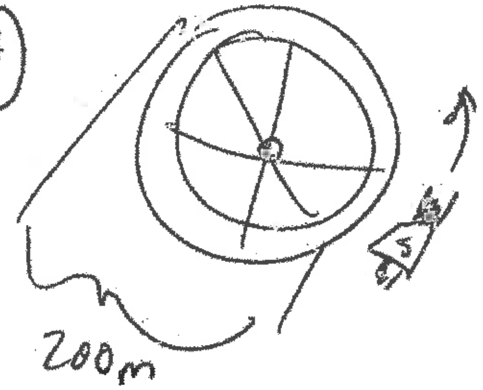
$m_B = 200\,kg \quad w = mg = 2000N$

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

2 Eq., 2 unknowns   Eliminate T to get

$$w_B - w_{HQ} = +\overset{200\,kg}{m_B}\,a + \overset{50\,kg}{m_{HQ}}\,a$$
$$2000N - 500N = a\,(250\,kg)$$
$$1500\,N = a\,(250\,kg)$$
$$\boxed{a = 6\,m/s^2}$$

4



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

What $v = ?$

what rev/minute ?

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

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

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

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

Rev/second first:

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

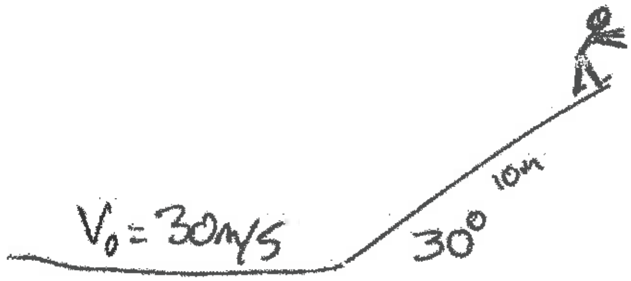
$V \cdot t = C \Rightarrow t = \frac{628m}{31.6m} = 19.87$ sec. for 1 rev.

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

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

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

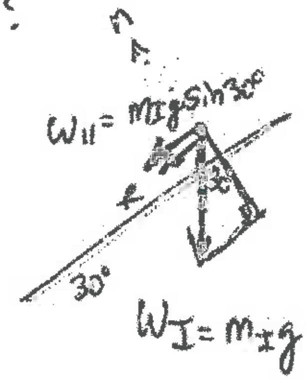
5



$\mu_K = 0,05$

$m_I = 70 kg$

$V_f = ?$



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

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

$a = -g\left(0,5 + \underbrace{(0.87)(0.05)}_{0,04}\right)$

$a = -10 \, m/s^2 \, (0,54)$

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

Const a ∥ to ice!

$x = x_0 + v_{0x} t + \frac{1}{2} a_x t^2$

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

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

Quad formula!

A = -2.7, B = 30, C = 10

$t = 0,34$ sec.

or

10.8 sec.

$V = V_0 + at$

$30 \quad -5.4 \quad 0.34$

1.8 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) $V_f = ?$

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

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

$$V = \left.\frac{100t^3}{3}\right|_0^t$$

Need t!

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

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

$$t^4 = 12\,m$$

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

Plug back into formulas

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

$$V_f = 214\ m/s$$