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Score: 18/20

#4: Dynamics, Force, Newtons laws of motion

1) acceleration?

$$a = \frac{F_T - F_g - mg}{m}$$

$$a = \frac{(1.25\times10^7 N) - (4.5\times10^6 N) - (70 kg)(9.8 N/kg)}{(70 kg)}$$

N/kg or m/s^2

114,275.9

1.14×10^7 m/s^2 or N/kg

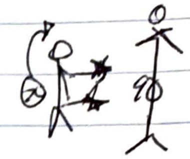
(-1) Not a reasonable result

(2) mass 70 kg, force 1,700 N

~~90 kg force 2?~~

$F_{net} = p - f = ma$

$F_{AB} = -F_{BA}$



Not sure

$700 = -700$??

How to find w/o "acc."?

1700 N = 1700 N?

Newton's 3rd Law, -700 N.

(3) decelerates 200 m/s^2
mass = 2,000 kg
Constant air resistance = 1000 N
what other force? = needed

ΣF_x?

~~F = ma~~

$\Sigma F_x = ma_x$

$(2000 kg)(200 m/s^2)$

= 400,000 N

Correct!

$T_1 = 73632$ N

$T_2 = 193$

Well done. I think the answers are right but it's hard to read ...

4) mass = 76 kg

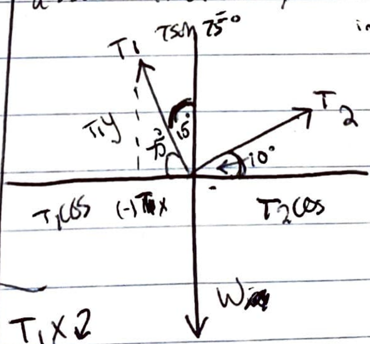
$\Sigma F_x = 0$

$\Sigma F_y = 0$

F_{net} x

F_{net} y

assume $F_{net} = 0$, calc. tensions in Ropes =



$-T_1 \cos 75 + T_2 \cos 10° = 0$

$-W + T_1 \sin 75° + T_2 \sin 10° = 0$

$T_1 x 2$

$\cos\theta = \frac{a}{h}$

$\cos(75) = \frac{-T_1 x}{T_1}$

$W = mg$

$(76 kg)(9.8 m/s^2)$

= 744.8 N

$\frac{T_1}{T_2} = \frac{\cos 10°}{\cos 75°}$

$T_1 = 3.805 T_2$

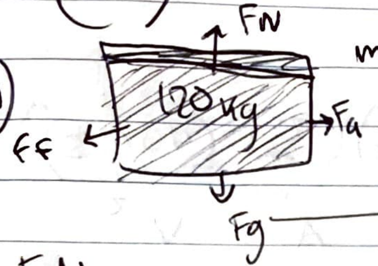
$3.805 T_2 \sin 75° + T \sin 10° = 744.8 N$

$T_2 = 193.514$ N

$T_1 = 3.805 \times 193.819$

736.324 N

1)



max force w/o moving = ? (a)

(μ_k = 0.5, 0.3)

mag of acceleration be = ?

$F_N = mg$

$= (120\,kg)(9.8\,N/kg)$

$F_{max} = \mu_s \cdot M \cdot g$

a) $= (0.5)(120\,kg)(9.8\,m/s^2)$

588 N is max force without moving

(b) $F_K = (\mu_K)(N) = (.3)(1176) = 352.8\,N$

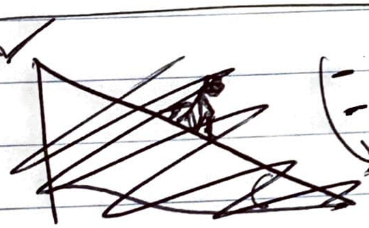
$F = F_{s\,max} - F_K$

$\underbrace{235.2}_{} = (588\,N) - (352.8\,N)$

$F = ma$

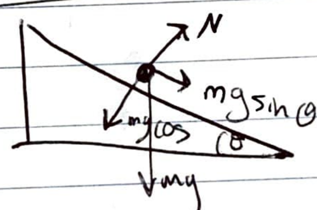
$F/m = a \quad \dfrac{(235.2\,N)}{(120\,kg)} = 1.96\,N/kg$

2)



- 25° incline
- $\mu_K = 0.1$

a = ?



$F_{net} = \cancel{m}g\sin\theta - \mu_K \cancel{m}g\cos\theta$

$a = (9.8\,m/s^2)\sin(25) - (0.1)(9.8\,m/s^2)\cos(25)$

$a = (4.14165) - (0.8881)$

$a = 3.25\,m/s^2$

(-1) Where is the problem solving for Young's modulus?

4.6

1) 144 km/hour

$V = r\omega$

$0.5 = R$

$$\frac{(144)\,km/hour}{0.5\ m} = \frac{288{,}000\ Revs}{1\ \text{per hour}} \cdot \frac{61\ hr}{60\ min} = 4{,}800\ RPM$$

in km (0.0005 km)

Radians/sec

$$\frac{4{,}800\ RPM}{1\ min} \cdot \frac{1\ min}{60\ sec} \cdot \frac{2\pi}{1\ Rev} = 502.65\ \text{Radians per sec.}$$

(-1) Math errors, 80 rad/sec

2# 4 km = 0.9 Km Rad.

(120 Km per hour limit)

~~FN = mg~~

~~FN cos θ = mg~~

~~FN = mg / cos θ~~

$\tan\theta = \frac{v^2}{rg}$

$$\frac{120\ km}{hour} \cdot \frac{1000\ m}{km} \cdot \frac{1\ hour}{3600\ sec} = 33.3\ m/sec = \text{velocity}$$

$0.9\ km \times 1000 = 900\ m$

$$\tan(\theta) = \frac{(33.3)^2}{(900)(9.8)}$$

in { parenthesis =

$$\theta = \tan^{-1}\left(\frac{(33.3)^2}{(900)(9.8)}\right)$$

$\theta = \tan^{-1}(.1257)$

$\theta = 7.16°$

3

a) Same friction, & centp. F?
safer at higher speed?

larger angles so path 2 can be taken at higher speeds. (correct)

b) path 1 — Radius of 400 m

2 — R of 800 m

$\mu_k = 1.0$

$F_f = CP$, what tangential velocities?

$F_c = ma_c$

$= \frac{mv^2}{r}$

$= mr\omega^2$

$$\frac{m \cdot v^2}{R}$$

constant

$$\frac{(1)\,x^2}{400} = v \quad 20?$$

$$\frac{(1)\,x^2}{800} = v \quad 28?$$

speeds? (-1)

3)

top speed = 40 m/s

area = 0.75 m^2

air density = 1.255 kg m^{-3}

C = 0.75

mag. in Newtons? of Drag force

$F_D = \frac{1}{2} C \rho A v^2$

$(1/2)(0.75)(1.255\ kg \cdot m^{-3})(0.75\ m^2)(40\ m/s)^2$

$C \quad \rho \quad A \quad v^2$

$F_D = 564.78\ N$

4) Bonus

acceleration due to gravity at Neptune due to pluto 4.5×10^{12} m apart

a) (mass 1.4×10^{22}) kg

b) uranus (8.62×10^{25} kg) 2.5×10^{12} m apart

AND compare

Uranus →

(a) $a = \frac{Gm}{r^2}$ $G = 6.67 \times 10^{-11} N \cdot m^2/kg^2$

$a = \frac{6.67 \times 10^{-11} \times 1.4 \cdot 10^{22}}{(4.5 \times 10^{12})^2}$

$a = 4.6 \times 10^{-14} m/s^2$

(b) $a = \frac{Gm}{r^2}$

$a = \frac{6.67 \times 10^{-11} \times 8.62 \times 10^{25} kg}{(2.5 \times 10^{12})^2}$

$a = 9.2 \times 10^{-10} m/s^2$

The acceleration due to gravity by presence ~~of pluto/uranus~~ of Uranus is greater than that of pluto.

(+2) Bonus