Score: 17/20

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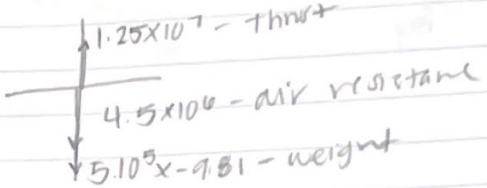
Midterm 2 - physics

1. $5 \times 10^5 kg \cdot -9.81 =$



a. thrust - gravitational force - air force / mass of rocket

$$a = \frac{1.25 \times 10^7 - 9.8 \times 5 \times 10^5 - 4.5 \times 10^6}{5 \times 10^5}$$

$$a = \frac{10^5 (125 - 49 - 45)}{5 \times 10^5}$$

$$\boxed{a = 6.2 \ m/s^2}$$

2. According to Newton's 3rd law every action has an equal and opposite reaction, therefore the second player exert on the 1st player 700 newtons

$F = \frac{ab}{-f\ ba}$ ab 700Newton^{ba} = -700 Newtons

3. $F = ma$

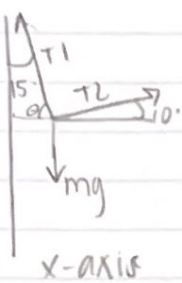
$(1000N + x) = (2000kg)(-200\ m/s^2)$

$(1000N + x) = -400{,}000$

$-1000 \qquad -1000$

$F = \boxed{x = -401{,}000}$

4. a)

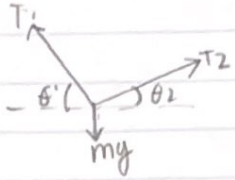


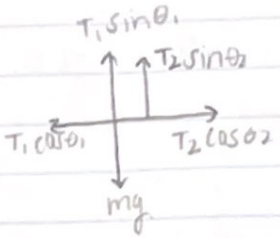
$m = 76\ kg$

$\theta_1 = 90° - 15$

$\theta_1 = 75°$

$\theta_2 = 10°$





x-axis

b) $T_2 \cos\theta_2 - T_1 \cos\theta_1 = F_{Net,x}$

y-axis

$T_1 \sin\theta_1 + T_2 \sin\theta_2 - mg = F_{net,y}$

where $\theta_1 = 75°$, + $\theta_2 = 10°$

$T_2 \cos 10 - T_1 \cos 75 = 0$

$T_1 \sin 75 - T_1 \cos 10 - (76 \cdot -9.81) = 0$

$a_x = a_y = 0$

x-axis

$T_1 \cos\theta_1 = T_2 \cos\theta_2$

$T_1 \cos 75 = T_2 \cos 10$

$T_1 \times 0.26 = T_2 \times 0.98$

$T_2 = \dfrac{T_2 \times 0.98}{0.26}$

y-axis

$T_1 \sin\theta_1 + T_2 \sin\theta_2 = mg$

$\dfrac{T_2 \times 0.98}{0.26} \times \sin 75° + T_2 \times \sin 10 = 76 \times 10$

$\dfrac{T_2 \times 0.98}{0.26} \times 0.96 + T_2 \times 0.17 = 760$

$T_2 \times 3.62 + T_2 \times 0.17 = 760$

$3.8\ T_2 = 760$

$T_2 = 200N$

$T_1 = 200 \times \dfrac{0.98}{0.26} = \boxed{753.8N}$

(The numbers are a little off but the derivation seems right)

Chapter 5

1. $g = 10\ m/s^2$, $m = 120\ kg$

$F = 0.5 \times (120 \times 10N) + 0.3 \times (120 \times 10N)$

$= 960\ N$

$a = 960 / 120 = \boxed{8\ m/s^2}$

(-1) There are two possible friction forces, static and kinetic, but they are not added

2. $mg\sin\theta - \mu N = ma$

$= 9.6\sin(25) - 0.1 \times 9.6\cos 25$

$= 4.14 - .09$

$= \boxed{3.68\ m/s^2}$

3. $F_D = \frac{1}{2} C_p A V^2$

$F_D = \frac{1}{2}(.75)(1.225)(.75)(40\ m/s)^2$

$\boxed{F_D = 551.25}$

4. $\frac{F}{A} = Y(\Delta x / L)$ $= 2300(3/4)$

$\boxed{= 1725\ N/m^2}$

$\Delta x = 3mm$

(-1) Units error

1. $V = r \cdot w$

$V = (.5)(144)$

$V = 72$

$\frac{144\ km}{hr} \left| \frac{1000}{} \right. = 144000 \cdot .5 = 72{,}000$

$\boxed{V = 72{,}000\ m/s}$

(-1) 80 rad/sec

2. $v = 120 \frac{km}{h} \times \frac{5}{18} = 33.\overline{3}$

$r = 0.9\ km \cdot 1000 = 900\ m$

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

$\tan\theta = \frac{33.3}{900 \cdot 9.81} =$

$= .21°$

(-1)

3 a. path 2.

b. $r = 400m$ 3 $\quad a = Ar$

$Vt = r \cdot w$

$= 400 \cdot 800$

$Vt = 320{,}000$

(-1) part b

Extra Credit

4. a $a_c = \frac{Gm}{r^2}$

$a_c = \frac{6.637 \times 10^{4} (1.4 \times 10^{22})}{(4.50 \times 10^{12})^2}$

$a_c = 4.61 \times 10^{-14}\ m/s^2$

b. $a_c = \frac{Gm}{r^2}$ $\frac{9.2 \times 10^{-10}}{4.61 \times 10^{-14}}$ $\frac{20,000}{1}$

(+2) well done

$a_c = \frac{6.673 \times 10^{-4} (0.42 \times 10^{25})}{(2.50 \times 10^{12})^2}$

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