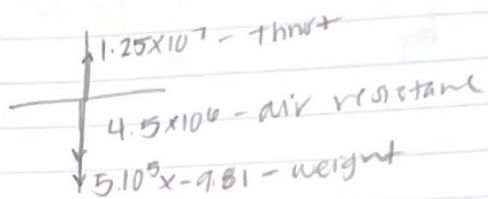


Midterm 2 - Physics

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



a. $\frac{\text{thrust} - \text{gravitational force} - \text{air force}}{\text{mass of rocket}}$

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

$$a = \frac{10^5 (125 - 49.45)}{5 \times 10^5}$$

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

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.

$$F = \frac{a_b}{-f_{ba}} \quad a_b 700 \text{ newtons} = -700 \text{ newtons}$$

3. $F = ma$

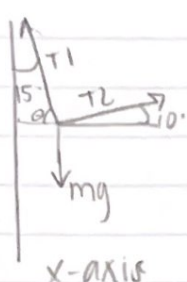
$$(1000 \text{ N} + x) = (2000 \text{ kg})(-200 \text{ m/s}^2)$$

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

$$\begin{array}{r} -1000 \\ -1000 \end{array}$$

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

4. a)

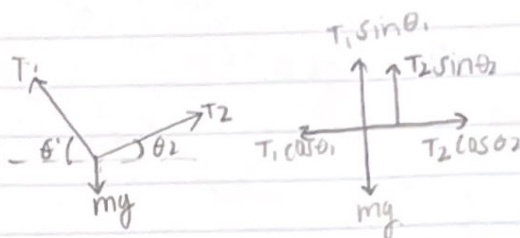


$$m = 70 \text{ kg}$$

$$\theta_1 = 90^\circ - 15^\circ$$

$$\theta_1 = 75^\circ$$

$$\theta_2 = 10^\circ$$



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

y-axis

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

where $\theta_1 = 75^\circ$, + $\theta_2 = 10^\circ$

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

$$T_1 \sin 75 - T_1 \cos 10 - (70 \cdot 9.81) = 0$$

$$a_x = a_y = 0$$

x-axis

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

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

$$T_1 \times 0.26 = T_2 \times 0.98$$

$$T_1 = \frac{T_2 \times 0.98}{0.26}$$

y-axis

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

$$\frac{T_2 \times 0.98}{0.26} \times \sin 75 + T_2 \times \sin 10 = 70 \times 10$$

$$\frac{T_2 \times 0.98}{0.26} \times 0.94 + T_2 \times 0.17 = 700$$

$$T_2 \times 3.62 + T_2 \times 0.17 = 700$$

$$3.8 T_2 = 700$$

$$T_2 = 200 \text{ N}$$

$$T_1 = 200 \times \frac{0.98}{0.26} = 753.84 \text{ N}$$

Chapter 5

$$1. \quad g = 10 \text{ m/s}^2, \quad m = 120 \text{ kg} \\ F = 0.5 \times (120 \times 10 \text{ N}) + 0.3 \times (120 \times 10 \text{ N}) \\ = 960 \text{ N}$$

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

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

$$= 9.8 \sin 25^\circ - 0.1 \times 9.8 \cos 25^\circ$$

$$= 4.41 - .89$$

$$= \boxed{3.60 \text{ m/s}^2}$$

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

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

$$\boxed{F_D = 551.25}$$

$$4. \quad \frac{F}{A} = \gamma (A_x / L) = 2300 (3/4)$$

$$\frac{F}{A} = 1725 \text{ N/m}^2$$

$$A_x = 3 \text{ mm}$$

$$1. \quad v = r \cdot \omega \\ v = (.5)(144) \\ v = 72$$

$$\frac{144 \text{ km}}{\text{hr}} \times \frac{1000}{1} = 144000 \cdot .5 = 72000$$

$$\boxed{v = 72000 \text{ m/s}}$$

$$2. v = 110 \frac{\text{km}}{\text{h}} \times \frac{5}{18} = 33.3$$

$$r = 0.9 \text{ km} \cdot 1000 = 900 \text{ m}$$

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

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

$$\boxed{= .21^\circ}$$

3^a path 2.

$$b. r = 400 \text{ m}$$

$$a = Ar$$

$$v_t = v \cdot \omega$$

$$= 400 \cdot 800$$

$$\boxed{v_t = 320,000 \text{ m/s}}$$

extra credit

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

$$a_c = \frac{6.637 \times 10^{-11} (1.4 \times 10^{22})}{(4.50 \times 10^{12})^2}$$

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

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

$$\frac{9.2 \times 10^{-10}}{4.61 \times 10^{-14}}$$

$$\frac{20,000}{1}$$

$$a_c = \frac{6.673 \times 10^{-11} (0.42 \times 10^{25})}{(2.50 \times 10^{12})^2}$$

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