chapter 4

Solutions

(1)

- Contact force due to the floor: This force is applied to the scale
- Contact force due to the person's feet: " " "
- Weight of the person: " " "
- Weight of the scale: is NOT applied to the scale

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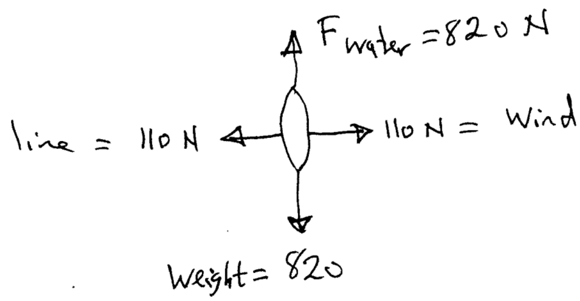
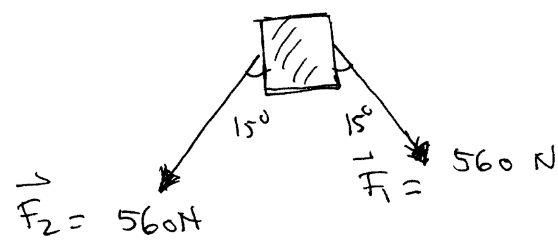
(15)

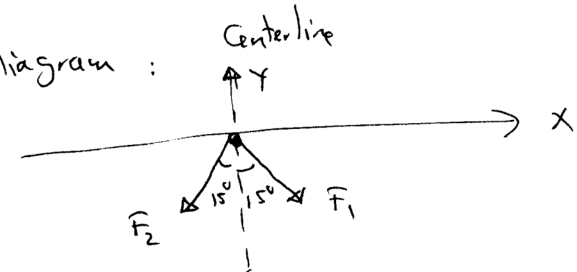


- The boat is at rest. Thus the upward force of the water must be equal to its weight.
- The net horizontal force must be zero too. Thus the force due to wind on sails must be equalized by the opposite force due to the line.

9



Free body diagram :



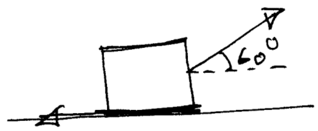
$$\sum F_x = \cancel{560 \sin 15^\circ} - \cancel{560 \sin 15^\circ} = 0$$

$$\sum F_y = -560 \cos 15^\circ - 560 \cos 15^\circ = -1082 \text{ N}$$

$$\Rightarrow \boxed{F_{net} = 1082 \text{ N} \quad \text{downward}}$$

(17)

$F = 5\ N$



$f = ?$

$\rightarrow V = \text{constant}$

$\downarrow$

$a = 0$

$\downarrow$

$\sum F_x = 0$

$\downarrow$

$F\cos 60^\circ - f = 0$

Contact force $= f = (5)(\cos 60^\circ) = \boxed{2.5\ N}$

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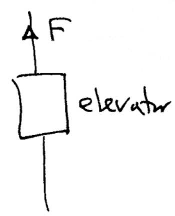
(22)

$m = 2530\ kg$

$F = 33.6\ kN$



a) $\sum F = ma$

$F - mg = ma$

$33600 - (2530)(9.8) = 2530\ a \Rightarrow \boxed{a = 3.5\ m/s^2}$

b) $V_i = 1.2\ m/s$, $\Delta t = 4\ s$, $V_f = ?$

$V_f = V_i + a\Delta t \Rightarrow V_f = 1.2 + 3.5 \times 4$

$\boxed{V_f = 15\ m/s}$

(24) $m = 2\,kg$

$v = \text{Constant} = 1.5\ m/s$

$\Downarrow$

$a = 0$

$\sum F_y = 0 \leftarrow$ ($a = 0$ because of Constant velocity)

$\Rightarrow F_{hand} - mg = 0 \rightarrow F_{hand} = (2)(9.8) = \boxed{19.6\,N}$

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(31) Forces acting on the Person:

The net upward force = the net downward force

a) $500\,N + 25 + 25 + F_{floor\ on\ feet} = 600$

$\Rightarrow F_{floor\ on\ feet} = 50\,N$

b) Forces acting on the Chair

The net upward force = The net downward force

$F_{floor} + F_{armrest} = 600 + 100$

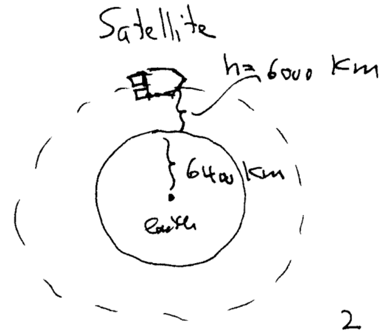
$F_{Floor} + 50 = 700 \rightarrow \boxed{F_{floor} = 650\,N}$

c) F_{Floor} (woman + chair system)

$F_{gravity}$

(41)

$$\frac{F_{\text{lanch pad}}}{F_{\text{orbit}}} = \frac{\dfrac{\cancel{G} M_s \cancel{M_E}}{R_E^2}}{\dfrac{\cancel{G M_s M_E}}{(R_E+h)^2}}$$



$$= \left(\frac{R_E+h}{R_E}\right)^2 = \left(1+\frac{h}{R_E}\right)^2 = \left(1+\frac{6000}{6400}\right)^2$$

$$= 3.75$$

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(45)

$$\begin{cases} m = 5 \text{ kg} \\ g_{\text{sea level}} = 9.792 \end{cases} \qquad h = ? \qquad g_{\text{high}} = 9.803$$

$$\frac{g_{\text{high}}}{g_{\text{sea level}}} = \frac{\dfrac{G M_E}{R_E^2}}{\dfrac{G M_E}{(R_E+h)^2}} = \left(\frac{R_E+h}{R_E}\right)^2 = \left(1+\frac{h}{R_E}\right)^2$$

$$\sqrt{\frac{9.803}{9.792}} = \; = 1 + \frac{h}{R_E} \rightarrow \frac{h}{R_E} = 0.00056$$

$$\boxed{h = 3.6 \text{ km}}$$