Answers, even-numbered Problems, Chapter 4

4.2. **(a)** The components of the net force are

$$R_x = -32 \text{ N}$$

$$R_y = 124 \text{ N}.$$

(b) $R = 128$ N, @ $104°$.

4.4.

(a) 69.3 N.
(b) 34.6 N.

4.6. **(a)** $F_x = -8.10$ N
$F_y = +3.00$ N.
(b) 8.64 N.

4.8. 189 N.
4.10. **(a)**, 90.9 kg.
(b). 22.0 m.

4.12. **(a)** 4.31 m/s^2.
(b). 215 m.
(c). 43.0 m/s.

4.14.

(a) 11.0 N. This maximum occurs in the interval $t = 0$ to $t = 2.00$ s.
(b) between 2.00 s and 6.00 s.
(c) 2.75 N .

4.16.

(a) 2.50×10^{14} m/s^2
(b) 1.2×10^{-8} s
(c) 2.28×10^{-16} N.

4.18

22.0 m/s^2

4.20.

(a) 1.81 m/s^2.
(b) 1.79 kg.

4.22

(a) the earth (gravity)

(b) 4 N; the book
(c) no, these two forces are exerted on the same object
(d) 4 N; the earth; the book; upward
(e) 4 N, the hand; the book; downward
(f) second (The two forces are exerted on the same object and this object has zero acceleration.)
(g) third (The forces are between a pair of objects.)
(h) No. There is a net upward force on the book equal to 1 N.
(i) No. The force exerted on the book by your hand is 5 N, upward. The force exerted on the book by the earth is 4 N, downward.
(j) Yes. These forces form a third-law pair and are equal in magnitude and opposite in direction.
(k) Yes. These forces form a third-law pair and are equal in magnitude and opposite in direction.
(l) One, only the gravity force.
(m) No. There is a net downward force of 5 N exerted on the book.

4.24

$0.452\ \mathrm{m/s^2}$, downward.

4.26. The only force on the ball is the gravity force, $\vec{F}_{grav}$. This force is mg, downward and is independent of the motion of the object.
The free-body diagram is sketched in Figure 4.26. The free-body diagram is the same in all cases.

Figure 4.26

(a) If the table is frictionless there is a net horizontal force on the combined object of the two blocks, and block *B* accelerates in the direction of the pull. The friction force that *B* exerts on *A* is to the right, to try to prevent *A* from slipping relative to *B* as *B* accelerates to the right. The free-body diagram is sketched in Figure 4.28a. *f* is the friction force that *B* exerts on *A* and *n* is the normal force that *B* exerts on *A*.

(b) The pull and the friction force exerted on *B* by the table cancel and the net force on the system of two blocks is zero. The blocks move with the same constant speed and *B* exerts no friction force on *A*. The free-body diagram is sketched in Figure 4.28b.

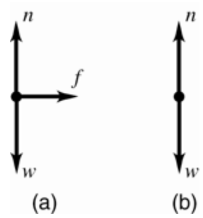


Figure 4.28

4.30. The free-body diagram for the box is given in Figure 4.30a. The free body diagram for the truck is given in Figure 4.30b.

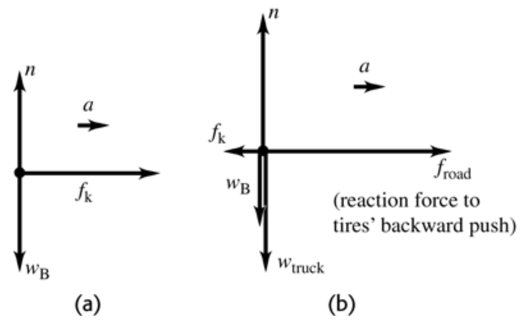


Figure 4.30

4.32. **(a)** The free-body diagram for the skier is given in Figure 4.32.
(b) 279 N.

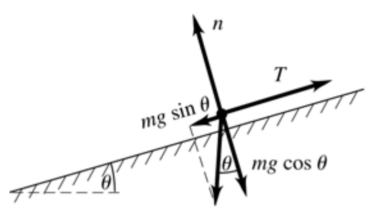


Figure 4.32

4.34.

(a) 7.43×10^{-4} s.
(b) 848 N.

4.36

0.41 N.
Note that g on Planet X is smaller than on earth and the object weighs less than it would on earth.

4.38

First, show that if the reef weren't there the ship would stop in a distance of 506 m,

so the ship would hit the reef. Then show that the speed when the tanker hits the reef is 0.17 m/s,
so that the oil should be safe.

4.40 3.7×10^{6} N.

4.42

(a) 539 N

(b) The free-body diagram is given in Fig. 4.42. $\sum F_y = 81$ N . upward.

(c) 1.5 m/s^2, upward.

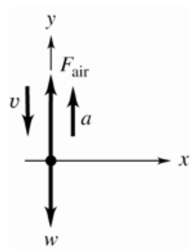


Figure 4.42

4.44.

(a) 80.0 N

(b) The cable is under tension.

(c) $0.762\ \text{m}/\text{s}^2$.

(d) 80.0 N. (but not part of an action-reaction pair)

(e) $8.84\times10^{-4}\ \text{m}/\text{s}^2$.

4.46.

(a) The velocity of the spacecraft is downward. When it is slowing down, the acceleration is upward. When it is speeding up, the acceleration is downward.

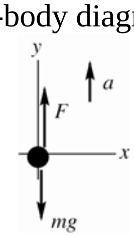
(b) In each case the net force is in the direction of the acceleration. Speeding up: $w > F$ and the net force is downward. Slowing down: $w < F$ and the net force is upward.

(c) 16.0×10^{3} N.

4.48. If the rocket is moving downward and its speed is decreasing, its acceleration is upward, just as in Problem 4.47. The solution is identical to that of Problem 4.47.

4.50

(a) The free-body diagram for the elevator is sketched in Figure 4.50.



Figure

The net force is $T - mg$ (upward).

4.50

2.93 m/s^2.

(b)
11.1 m/s^2.

4.52.

(a) The free-body diagram for the hammer head is sketched in Figure 4.52.
(b) 590 N
(c) 2153 N, or about 2200 N.

Figure 4.52

4.54.

(a) The free-body diagrams for each block and for the rope are given in Figure 4.54a.

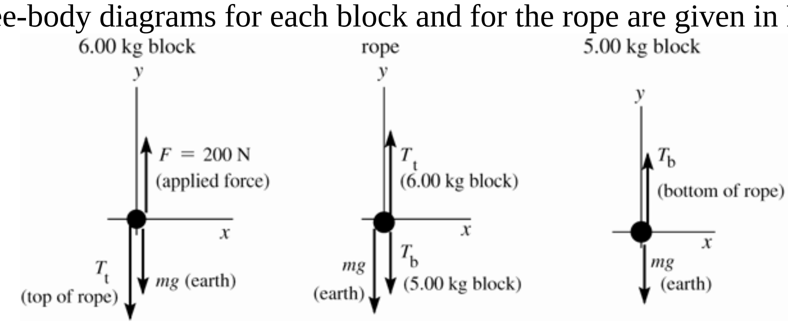


Figure 4.54a

T_t is the tension at the top of the rope and T_b is the tension at the bottom of the rope.

(b) 3.53 m/s^2

(c) 120 N

(d) 93.3 N

4.56.

(a) The free-body diagram for the descending balloon is given in Figure 4.56.
L is the lift force.
(b) $2Mg/3$.

(c) Mass $5M/9$ must be dropped overboard.

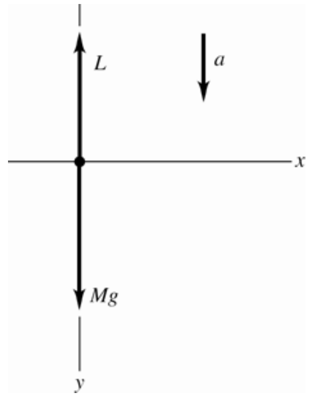


Figure 4.56

4.58 $(1.7\times10^{4}\ \text{N})\hat{\text{i}} - (3.4\times10^{3}\ \text{N})\hat{\text{k}}$

4.60.

$$\vec{\text{v}}(t) = \frac{1}{m}\int_0^t \vec{\text{F}}\,dt = \frac{1}{m}\left(k_1 t\hat{\text{i}} + \frac{k_2}{4}t^4\hat{\text{j}}\right).$$

4.62.

$$\vec{\text{r}}(t) = \left(\frac{k_1}{2m}t^2 + \frac{k_2k_3}{120m^2}t^5\right)\hat{\text{i}} + \left(\frac{k_3}{6m}t^3\right)\hat{\text{j}} \text{ and } \vec{\text{v}}(t) = \left(\frac{k_1}{m}t + \frac{k_2k_3}{24m^2}t^4\right)\hat{\text{i}} + \left(\frac{k_3}{2m}t^2\right)\hat{\text{j}}.$$