

Physics: Unit 5 Textbook problems on Newton's Laws and Forces.

Textbook Ch. 4 p. 151-155 #s 7, 8, 9, 10, 12, 19-21, 25, 27, 33, 36, 37, 48, 50, & 52

7. Draw a free-body diagram representing each of the following objects:

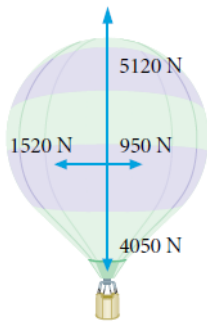
- a. a ball falling in the presence of air resistance
- b. a helicopter lifting off a landing pad
- c. an athlete running along a horizontal track

8. A chair is pushed forward with a force of 185 N. The gravitational force of Earth on the chair is 155 N downward, and the floor exerts a force of 155 N upward on the chair. Draw a free-body diagram showing the forces acting on the chair.

9. The gravitational force of Earth on a cake on a plate is 8.9 N downward. The plate exerts a force of 11.0 N upward on the cake, and a knife exerts a downward force of 2.1 N on the cake. Draw a free-body diagram of the cake.

**Practice problems**

10. Four forces act on a hot-air balloon, shown from the side in **Figure 4-29**. Find the magnitude and direction of the resultant force on the balloon. (See Sample Problem 4A.)



**Figure 4-29**

12. A dog pulls on a pillow with a force of 5 N at an angle of  $37^\circ$  above the horizontal. Find the  $x$  and  $y$  components of this force.

(See Sample Problem 4A.)

19. An 1850 kg car is moving to the right at a constant speed of 1.44 m/s.

- a. What is the net force on the car?
- b. What would be the net force on the car if it were moving to the left?

20. What acceleration will you give to a 24.3 kg box if you push it with a force of 85.5 N?

(See Sample Problem 4B.)

21. A freight train has a mass of  $1.5 \times 10^7$  kg. If the locomotive can exert a constant pull of  $7.5 \times 10^5$  N, how long would it take to increase the speed of the train from rest to 85 km/h? (Disregard friction.)

(See Sample Problem 4B.)

25. A shopper in a supermarket pushes a loaded 32 kg cart with a horizontal force of 12 N.
- How far will the cart move in 3.5 s, starting from rest? (Disregard friction.)
  - How far will the cart move in 3.5 s if the shopper places an 85 N child in the cart before pushing?
- (See Sample Problem 4B.)
27. A 0.150 kg baseball is thrown upward with an initial speed of 20.0 m/s.
- What is the force on the ball when it reaches half of its maximum height? (Disregard air resistance.)
  - What is the force on the ball when it reaches its peak?
33. A ball is held in a person's hand.
- Identify all the external forces acting on the ball and the reaction force to each.
  - If the ball is dropped, what force is exerted on it while it is falling? Identify the reaction force in this case. (Disregard air resistance.)
36. A sky diver falls through the air. As the speed of the sky diver increases, what happens to the sky diver's acceleration? What is the acceleration when the sky diver reaches terminal speed?
37. A 95 kg clock initially at rest on a horizontal floor requires a 650 N horizontal force to set it in motion. After the clock is in motion, a horizontal force of 560 N keeps it moving with a constant velocity. Find  $\mu_s$  and  $\mu_k$  between the clock and the floor.  
(See Sample Problem 4C.)
48. A 2.26 kg book is dropped from a height of 1.5 m.
- What is its acceleration?
  - What is its weight in newtons?
50. A 5.0 kg bucket of water is raised from a well by a rope. If the upward acceleration of the bucket is  $3.0 \text{ m/s}^2$ , find the force exerted by the rope on the bucket of water.
52. A boat moves through the water with two forces acting on it. One is a  $2.10 \times 10^3 \text{ N}$  forward push by the motor, and the other is a  $1.80 \times 10^3 \text{ N}$  resistive force due to the water.
- What is the acceleration of the 1200 kg boat?
  - If it starts from rest, how far will it move in 12 s?
  - What will its speed be at the end of this time interval?