CHAPTER 8: Rotational Motion

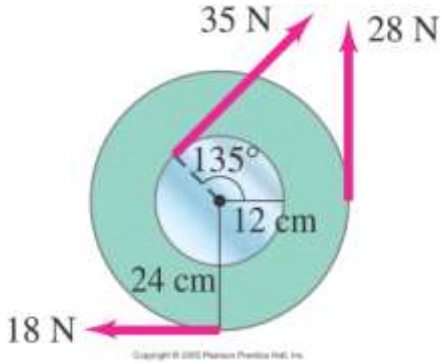
Problems

8–4 Torque

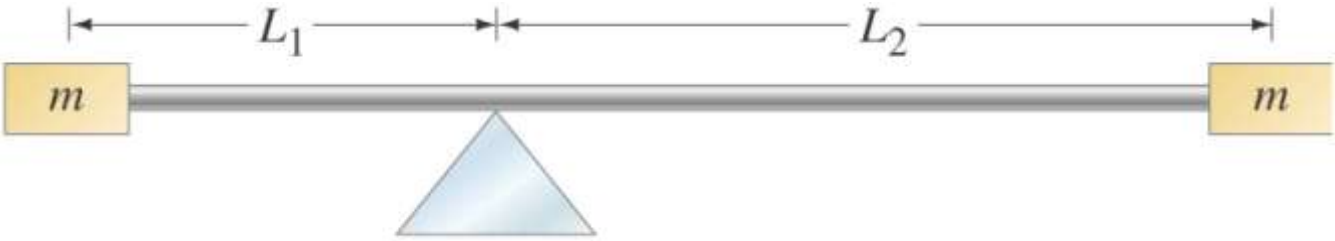
22. (I) A 55-kg person riding a bike puts all her weight on each pedal when climbing a hill. The pedals rotate in a circle of radius 17 cm. (*a*) What is the maximum torque she exerts? (*b*) How could she exert more torque?

23. (I) A person exerts a force of 55 N on the end of a door 74 cm wide. What is the magnitude of the torque if the force is exerted (*a*) perpendicular to the door, and (*b*) at a 45º angle to the face of the door?

24. (II) Calculate the net torque about the axle of the wheel shown in Fig. 8–39. Assume that a friction torque of $0.40\,\mathrm{m\cdot N}$ opposes the motion.



25. (II) Two blocks, each of mass *m*, are attached to the ends of a massless rod which pivots as shown in Fig. 8–40. Initially the rod is held in the horizontal position and then released. Calculate the magnitude and direction of the net torque on this system.



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CHAPTER 9: Static Equilibrium; Elasticity and Fracture

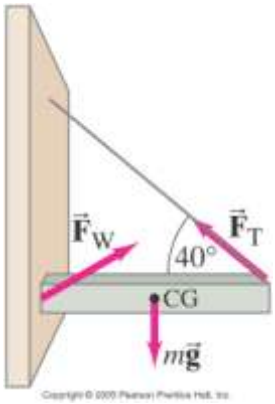
Problems

9–1 and 9–2 Equilibrium

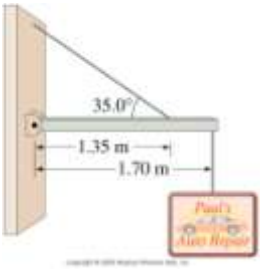
3. (I) Calculate the mass m needed in order to suspend the leg shown in Fig. 9–43. Assume the leg (with cast) has a mass of 15.0 kg, and its CG is 35.0 cm from the hip joint; the sling is 80.5 cm from the hip joint.

6. (II) Calculate the forces F_A and F_B that the supports exert on the diving board of Fig. 9–42 when a 58-kg person stands at its tip. (*a*) Ignore the weight of the board. (*b*) Take into account the board's mass of 35 kg. Assume the board's CG is at its center.

9. (II) A 75-kg adult sits at one end of a 9.0-m-long board. His 25-kg child sits on the other end. (*a*) Where should the pivot be placed so that the board is balanced, ignoring the board's mass? (*b*) Find the pivot point if the board is uniform and has a mass of 15 kg.



18. (II) Calculate (*a*) the tension F_T in the wire that supports the 27-kg beam shown in Fig. 9–52, and (*b*) the force $\vec{F}_W$ exerted by the wall on the beam (give magnitude and direction).



20. (II) A shop sign weighing 245 N is supported by a uniform 155-N beam as shown in Fig. 9–54. Find the tension in the guy wire and the horizontal and vertical forces exerted by the hinge on the beam.

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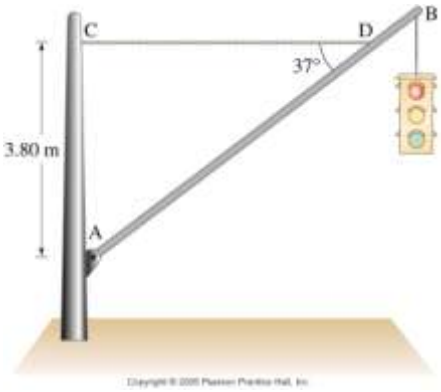
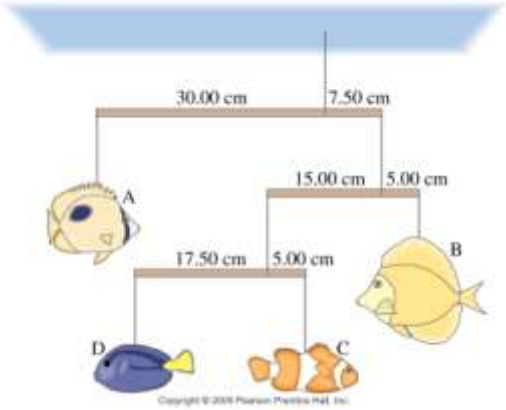
21. (II) A traffic light hangs from a pole as shown in Fig. 9–55. The uniform aluminum pole AB is 7.50 m long and has a mass of 12.0 kg. The mass of the traffic light is 21.5 kg. Determine (*a*) the tension in the horizontal massless cable CD, and (*b*) the vertical and horizontal components of the force exerted by the pivot A on the aluminum pole.

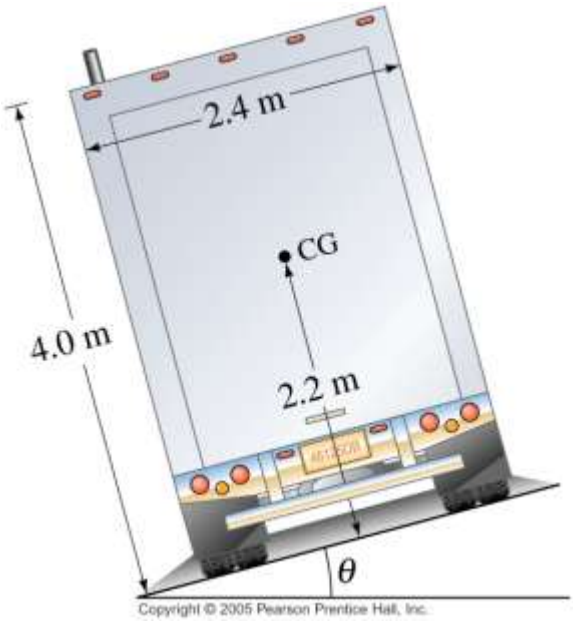


57. The mobile in Fig. 9–71 is in equilibrium. Object B has mass of 0.885 kg. Determine the masses of objects A, C, and D. (Neglect the weights of the crossbars.)



58. A tightly stretched "high wire" is 46 m long. It sags 2.2 m when a 60.0-kg tightrope walker stands at its center. What is the tension in the wire? Is it possible to increase the tension in the wire so that there is no sag?

63. The center of gravity of a loaded truck depends on how the truck is packed. If it is 4.0 m high and 2.4 m wide, and its CG is 2.2 m above the ground, how steep a slope can the truck be parked on without tipping over (Fig. 9–75)?



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