* 56. (II) The subterranean tension ring that exerts the balancing horizontal force on the abutments for the dome in Fig. 9–34 is 36-sided, so each segment makes a 10° angle with the adjacent one (Fig. 9–70). Calculate the tension F that must exist in each segment so that the required force of 4.2×10^5 N can be exerted at each corner (Example 9–13).

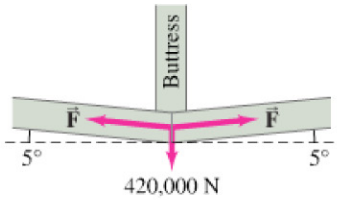

FIGURE 9–70 Problem 56.

General Problems

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.)

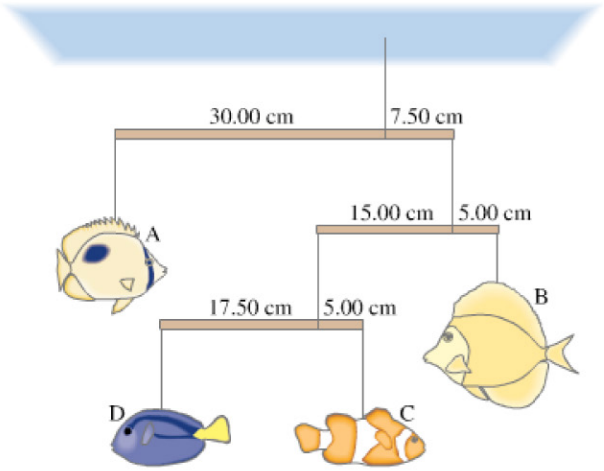

FIGURE 9–71 Problem 57.

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?

59. What minimum horizontal force F is needed to pull a wheel of radius R and mass M over a step of height h as shown in Fig. 9–72 ($R > h$)? (*a*) Assume the force is applied at the top edge as shown. (*b*) Assume the force is applied instead at the wheel's center.

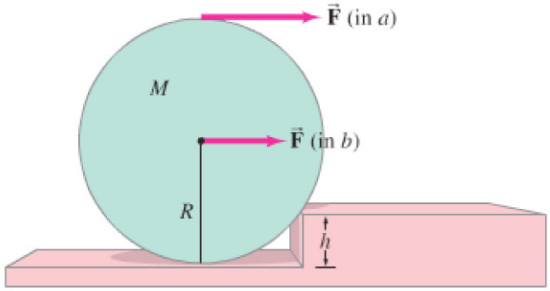

FIGURE 9–72 Problem 59.

60. A 25-kg round table is supported by three legs equal distances apart on the edge. What minimum mass, placed on the table's edge, will cause the table to overturn?

61. When a wood shelf of mass 5.0 kg is fastened inside a slot in a vertical support as shown in Fig. 9–73, the support exerts a torque on the shelf. (*a*) Draw a free-body diagram for the shelf, assuming three vertical forces (two exerted by the support slot—explain why). Then calculate (*b*) the magnitudes of the three forces and (*c*) the torque exerted by the support (about the left end of the shelf).

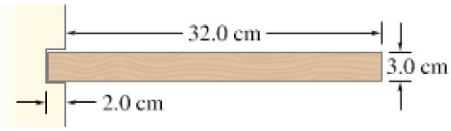

FIGURE 9–73 Problem 61.

62. A 50-story building is being planned. It is to be 200.0 m high with a base 40.0 m by 70.0 m. Its total mass will be about 1.8×10^7 kg, and its weight therefore about 1.8×10^8 N. Suppose a 200-km/h wind exerts a force of 950 N/m^2 over the 70.0-m-wide face (Fig. 9–74). Calculate the torque about the potential pivot point, the rear edge of the building (where $\vec{\mathbf{F}}_E$ acts in Fig. 9–74), and determine whether the building will topple. Assume the total force of the wind acts at the midpoint of the building's face, and that the building is not anchored in bedrock. [*Hint*: $\vec{\mathbf{F}}_E$ in Fig. 9–74 represents the force that the Earth would exert on the building in the case where the building would just begin to tip.]

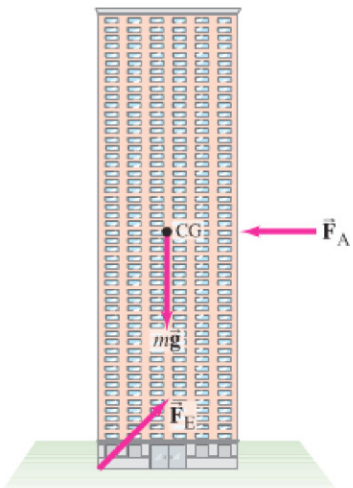

FIGURE 9–74 Forces on a building subjected to wind ($\vec{\mathbf{F}}_A$), gravity ($m\vec{\mathbf{g}}$), and the force $\vec{\mathbf{F}}_E$ on the building due to the Earth if the building were just about to tip. Problem 62.