

No 1

71 SSM In Fig. 11-60, a constant horizontal force $\vec{F}_{\text{app}}$ of magnitude 12 N is applied to a uniform solid cylinder by fishing line wrapped around the cylinder. The mass of the cylinder is 10 kg, its radius is 0.10 m, and the cylinder rolls smoothly on the horizontal surface. (a) What is the magnitude of the acceleration of the center of mass of the cylinder? (b) What is the magnitude of the angular acceleration of the cylinder about the center of mass? (c) In unit-vector notation, what is the frictional force acting on the cylinder?

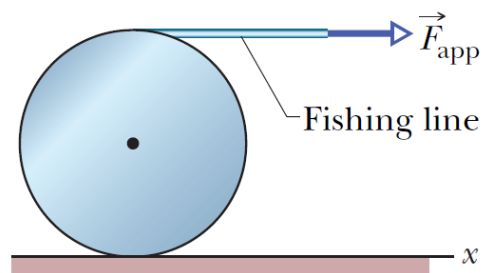


Fig. 11-60 Problem 71.

No 2

••45 In Fig. 12-54, a lead brick rests horizontally on cylinders *A* and *B*. The areas of the top faces of the cylinders are related by $A_A = 2A_B$; the Young's moduli of the cylinders are related by $E_A = 2E_B$. The cylinders had identical lengths before the brick was placed on them. What fraction of the brick's mass is supported (a) by cylinder *A* and (b) by cylinder *B*? The horizontal distances between the center of mass of the brick and the centerlines of the cylinders are d_A for cylinder *A* and d_B for cylinder *B*. (c) What is the ratio d_A/d_B ?

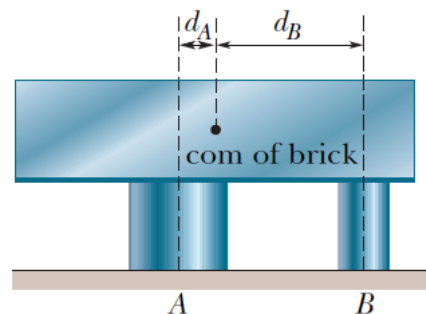


Fig. 12-54 Problem 45.

83  Figure 14-56 shows a *siphon*, which is a device for removing liquid from a container. Tube ABC must initially be filled, but once this has been done, liquid will flow through the tube until the liquid surface in the container is level with the tube opening at A . The liquid has density 1000 kg/m^3 and negligible viscosity. The distances shown are $h_1 = 25 \text{ cm}$, $d = 12 \text{ cm}$, and $h_2 = 40 \text{ cm}$. (a) With what speed does the liquid emerge from the tube at C ? (b) If the atmospheric pressure is $1.0 \times 10^5 \text{ Pa}$, what is the pressure in the liquid at the topmost point B ? (c) Theoretically, what is the greatest possible height h_1 that a siphon can lift water?

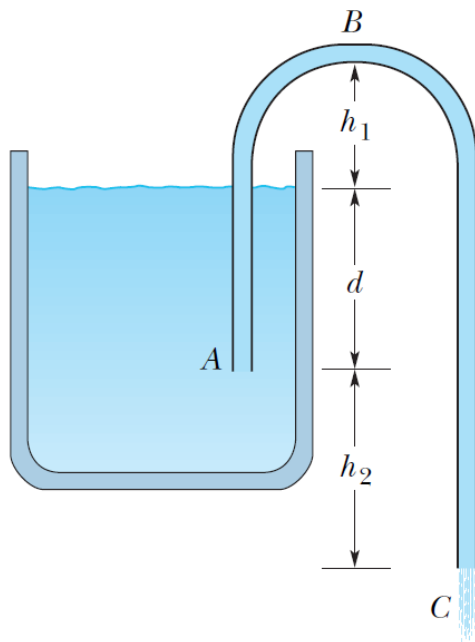


Fig. 14-56 Problem 83.

No 4

100 In Fig. 15-57, a solid cylinder attached to a horizontal spring ($k = 3.00 \text{ N/m}$) rolls without slipping along a horizontal surface. If the system is released from rest when the spring is stretched by 0.250 m , find (a) the translational kinetic energy and (b) the rotational kinetic energy of the cylinder as it passes through the equilibrium position. (c) Show that under these conditions the cylinder's center of mass executes simple harmonic motion with period

$$T = 2\pi \sqrt{\frac{3M}{2k}},$$

where M is the cylinder mass. (*Hint:* Find the time derivative of the total mechanical energy.)

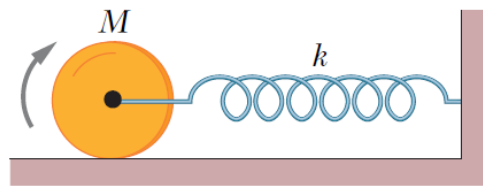


Fig. 15-57 Problem 100.