Challenge Exercises for Further Study

B-1: Ezra, a 60.0-kg high school student, is sleeping on his waterbed when his 2.0-kg cat, Muffin, jumps onto his back, causing Ezra to sink 2.0 cm deeper into the waterbed. a) If Muffin then jumps off Ezra from this new equilibrium position, what will be the period of Ezra's bobbing motion on the waterbed? b) Will this period slow down, speed up, or remain the same as the amplitude of the bounces gets smaller and smaller? Explain your answer.

B-2: Andy (mass 80.0 kg), Randy (mass 60.0 kg), and twins Candy and Mandy (each with a mass of 70.0 kg) climb into a 1000.-kg car, causing each of the four springs to compress 4.00 cm. Find the period of vibration of the car as it comes to rest after the four get in.

B-3: Tanja talks long distance with her boyfriend every night from her dormitory pay phone, and her phone bills are getting rather high. She has decided that she must limit each of her calls to 10 minutes. Since Tanja doesn't have a watch, she devises a unique way to time her calls. Tanja notices that the pay phones each have a cord that is 0.800 m long. Therefore, as she talks on one phone, she can swing the receiver of the adjacent phone to time her call. How many complete swings will the nearby phone receiver make before Tanja must hang up?

B-4: On a 0°C-winter day, a 10.000-m-long brass Foucault pendulum hanging in the covered entrance to the science museum swings back and forth with the rotation of Earth. The outdoor temperature variations range from 0°C in the winter to 30.0°C in the summer. How does the period of the pendulum change throughout the year? ($\alpha_{brass} = 19 \times 10^{-6}$°C^{-1})

B-5: Gillian buys a pendulum clock at a discount store and discovers when she gets it home that it loses 6.00 minutes each day. a) Should she lengthen or shorten the pendulum in order for it to keep accurate time? b) If the pendulum has a period of 2.00 s, by how much must the length be changed so that the clock keeps accurate time?